Alcohol Consumption and Risk of Type 2 Diabetes Among Older Women

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OBJECTIVE — This study aimed to investigate the relation between alcohol consumption and type 2 diabetes among older women.

RESEARCH DESIGN AND METHODS — Between 1993 and 1997, 16,330 women aged 49–70 years and free from diabetes were enrolled in one of the Dutch Prospect-EPIC (European Prospective Study Into Cancer and Nutrition) cohorts and followed for 6.2 years (range 0.1–10.1). At enrollment, women filled in questionnaires and blood samples were collected.

RESULTS — During follow-up, 760 cases of type 2 diabetes were documented. A linear inverse association ($P = 0.007$) between alcohol consumption and type 2 diabetes risk was observed, adjusting for potential confounders. Compared with abstainers, the hazard ratio for type 2 diabetes was 0.86 (95% CI 0.66–1.12) for women consuming 5–30 g alcohol per week, 0.66 (0.48–0.91) for 30–70 g per week, 0.91 (0.67–1.24) for 70–140 g per week, 0.64 (0.44–0.93) for 140–210 g per week, and 0.69 (0.47–1.02) for >210 g alcohol per week. Beverage type did not influence this association. Lifetime alcohol consumption was associated with type 2 diabetes in a U-shaped fashion.

CONCLUSIONS — Our findings support the evidence of a decreased risk of type 2 diabetes with moderate alcohol consumption and expand this to a population of older women.

Diabetes Care **28:2933–2938, 2005**

Type 2 diabetes is a major disease burden in developed and developing countries and its prevalence is expected to double in the next 20 years (1). Alcohol consumption is associated with type 2 diabetes in a U-shaped fashion, indicating a decreased risk of type 2 diabetes with moderate alcohol consumption compared with both abstaining and excessive drinking (2). This relation has mostly been investigated among male populations (2). Three studies included both men and women and two included younger women up to 55 years of age (3,4). Only one study of Lee et al. (5) describing the association between dietary iron and type 2 diabetes reported on the association of alcohol consumption with type 2 diabetes among postmenopausal women.

Data on this relation among older women are therefore particularly scarce. Meanwhile, the prevalence of type 2 diabetes is increasing with age and the majority of type 2 diabetic patients are women (1,6). The cumulative influence of lifetime alcohol consumption also remains unexamined. Therefore, we examined the relation between both current and lifetime alcohol consumption and risk of type 2 diabetes in a large population-based prospective cohort study consisting of women aged >50 years.

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Received for publication 21 June 2005 and accepted in revised form 7 September 2005.

Abbreviations: FFQ, food frequency questionnaire.

A table elsewhere in this issue shows conventional and Système International (SI) units and conversion factors for many substances.

RESEARCH DESIGN AND METHODS

— A follow-up study was performed among 17,357 women aged 49–70 who participated in the breast cancer screening Prospect-EPIC (European Prospective Study Into Cancer and Nutrition) cohort between 1993 and 1999, one of two Dutch contributions to EPIC. The design, sampling strategies, and examination techniques of the cohort have been described previously (7). All women signed informed consent before study inclusion. The study complies with the Declaration of Helsinki and was approved by the Institutional Review Board of the University Medical Center Utrecht. Of the total cohort of 17,357 women, we excluded 119 women with missing data on alcohol consumption, 367 with missing data on occurrence of type 2 diabetes, and 17 with missing data on BMI. Furthermore, 524 women reported diabetes at baseline and were therefore excluded, leaving 16,330 women for the present study. From the original cohort of 17,357 women, a 10% random sample was drawn and the same exclusion criteria were applied, leaving 1,385 women. Serum HDL cholesterol was assessed in this random sample.

Baseline measurements

At baseline, questionnaires were mailed to women who agreed to participate, and these were returned when the women visited for breast cancer screening (7). A general questionnaire included questions on demographic characteristics and presence of and risk factors for chronic diseases. Diabetes was defined as present based on a physician-diagnosed self-report. Waist and hip circumferences, height, and weight were measured, and BMI was calculated. Systolic and diastolic blood pressure were measured twice at the right arm with an automated and calibrated blood pressure device with the subject in supine position, and the mean was calculated. Hypertension and hypercholesterolemia were defined as present based on a physician-diagnosed self-report. Women were assumed to be postmenopausal when they reported not having menstrual periods for at least a year. Physical activity was assessed using a questionnaire validated in an elderly population (8). Daily energy

intake was obtained from a food frequency questionnaire (FFQ) containing questions on the usual frequency of consumption of 77 main food items during the year preceding enrollment. This questionnaire allows the estimation of the average daily consumption of 178 foods. The FFQ had been validated before the start of the study (9,10). At baseline all women donated a nonfasting blood sample. Serum HDL cholesterol was determined for the random sample using an automated enzymatic procedure on a Vitros 250 (Johnson & Johnson, Rochester, NY).

Assessment of alcohol consumption

Alcohol consumption was assessed by the general questionnaire and FFQ. The validity of this alcohol intake assessment is good as confirmed by a Spearman correlation of 0.87 between the FFQ and 12- to 24-h recalls (9). The general questionnaire contained four questions regarding previous alcohol consumption. Subjects were asked whether they had ever used alcohol. If so, they were asked how many units of beer, wine, port/sherry/vermouth, and spirits they drank at ages 20 and 40 (none, less than 1 unit a week, or to indicate the number of units a week). The FFQ contained one question regarding the number of units of alcohol-free beer, beer, white wine, red wine, port/sherry/vermouth, and spirits consumed during the year before enrollment. Subjects indicated their consumption frequency on a daily/weekly/monthly/yearly scale or as never consumed. Baseline alcohol intake was determined by multiplying the consumption of each beverage by its ethanol content (10 g for beer and fortified wine, 9.6 g for wine, and 9.8 g for liquor) (11) and was categorized into seven categories: teetotalers, 0–4.9 g/week, 5–29.9 g/week, 30–69.9 g/week, 70–139.9 g/week, 140–209.9 g/week, and ≥210 g/week.

To assess the influence of alcohol consumption earlier in life, we calculated lifetime alcohol consumption based on reported alcohol consumption at age 20 and 40 and calculated the number of years drinking one standard alcoholic beverage of 10 g alcohol daily (alcohol-years). We determined the number of standard alcoholic beverages containing 10 g of alcohol consumed daily at age 20 and 40. The amount consumed at age 20 was assumed to remain unchanged until age 30 and the amount consumed at age 40 from 30 until inclusion in the study. Alcohol-years were calculated by multiplying the number of alcoholic beverages of 10 g daily with the number of years this amount of alcohol was consumed: from 20–30 years and from 30 to inclusion. Alcohol-years from 20–30 years and 30 to inclusion were added up and categorized into seven groups: 0 (teetotalers), 0.1–4.9, 5–9.9, 10–19.9, 20–29.9, 30–49.9, and ≥50 alcohol-years of drinking one standard alcoholic beverage of 10 g alcohol daily. The validity of such retrospective assessment of components of the diet (including alcohol) has been recently investigated in a similar population and is shown to provide a reasonable record (12).

Assessment of type 2 diabetes

Two follow-up questionnaires regarding occurrence of disease were sent to the participants in 3- to 5-year intervals. The occurrence of type 2 diabetes was assessed by self-reported occurrence of diabetes in the follow-up questionnaires and/or a urinary glucose strip test for detection of glucosuria and/or a Dutch register of hospital discharge diagnoses. Type 2 diabetes was defined as present when either of these methods reported a positive response. Follow-up questionnaires contained seven questions addressing the occurrence of diabetes. Subjects were asked whether diabetes was diagnosed and if so in what year, by whom, and whether they were treated by a diet, oral blood glucose–lowering drugs, and/or insulin. With the first follow-up questionnaire, subjects received a urinary glucose strip test and were asked whether the urine strip had turned purple after 10 s, indicating glucosuria. Response rate of self-reported occurrence of type 2 diabetes was 80% from the first follow-up questionnaire, 91% at the second follow-up questionnaire, and 73% for returning the outcome of the urinary glucose strip test. Data on diagnosis of type 2 diabetes were obtained from the Dutch Centre for Health Care Information, which holds a standardized computerized register of hospital discharge diagnoses. Admission files have been filed continuously from all general and university hospitals in the Netherlands from 1990. Data on sex, date of birth, and dates of admission and discharge have been recorded whenever a patient is discharged from the hospital. One mandatory principal diagnosis and up to nine optional additional diagnoses were reported. All diagnoses were coded according to the ICD-9-CM. Follow-up was complete until 1 January 2002. The database was linked to the cohort on the basis of birth date, sex, postal code, and general practitioner with a validated probabilistic method (13). Information on vital status was obtained through linkage with the municipal administration registries.

Statistical analysis

Data analysis was performed using SPSS for Windows version 12.0 (SPSS, Chicago, IL). The association between alcohol consumption and HDL cholesterol was determined using regression analysis. The duration of follow-up was calculated as the interval between date of study entry and the diagnosis of type 2 diabetes, death, loss to follow-up, or 1 January 2002. Hazard ratios (HRs) for each baseline alcohol intake category were calculated using Cox proportional hazards with teetotalers as a reference group. Age- and BMI-adjusted HRs and 95% CIs were estimated. We used a multivariate model to adjust for other confounding factors: smoking status (non-, former, current smokers), physical activity level (five categories), menopausal status (pre-, postmenopausal, and unknown), education (seven categories), systolic blood pressure (six categories), hypertension (present or not), hypercholesterolemia (present or not), family history of diabetes (none, one parent, or both), daily energy intake (four categories), waist circumference (six categories), and hip circumference (five categories). Linear trend across alcohol consumption categories were computed by including alcohol intake categories in the model as linear covariate. The square of this term was used to assess the quadratic trend across alcohol consumption categories. The influence of alcohol consumption earlier in life independent from current alcohol consumption was assessed by estimating HRs based on categories of alcohol-years using the same models as for baseline alcohol consumption. We adjusted for baseline alcohol consumption by including it as a continuous variable in the model, because the categorical variables of baseline alcohol consumption and alcohol-years were correlated ($r = 0.73$; $P < 0.001$).

We assessed the risk associated with individual beverage types controlling for the covariates included in the multivariate model and intake of each of the other beverage types. Teetotalers were excluded from this analysis. Wine consumption was separated into four categories, as it was consumed in larger quantities than the other beverages. Fortified wine and

Table 1—*Baseline characteristics* by alcohol consumption categories in 16,330 Dutch women*

	Alcohol consumption (g/week)						
	Teetotaler	0–4.9	5–29.9	30–69.9	70–139.9	140–209.9	≥210
Participants (*n*)	1,513	3,115	3,787	2,586	2,384	1,629	1,316
Age (years)†	59 ± 6	59 ± 6	58 ± 6	57 ± 6	57 ± 6	57 ± 6	56 ± 6
BMI (kg/m^2)†	26.9	26.6	26.2	25.8	25.1	25.3	25.3
Waist circumference (cm)†	85.2	84.8	83.6	82.8	81.8	82.6	83.5
Beer (g/day)	0	0	0.1	0.4	0.8	1.0	2.6
Wine (g/day)	0	0.1	1.2	3.6	6.3	10.9	17.8
Fortified wine (g/day)	0	0.1	0.5	1.7	4.3	8.7	13.9
Spirits (g/day)	0	0	0.3	1.0	2.3	3.5	8.7
Systolic blood pressure (mmHg)†	135.4	132.7	131.6	131.1	130.1	132.0	134.3
Diastolic blood pressure (mmHg)†	79.5	78.7	78.2	78.2	77.5	78.9	80.2
Current smoker (%)†	18.2	21.3	17.2	18.6	23.9	33.0	43.6
Past smoker (%)†	14.8	30.6	31.7	39.7	43.2	41.3	38.8
Hypertension (%)†	23.4	22.4	19.5	17.8	15.4	17.0	18.6
Hypercholesterolemia (%)†	6.4	6.6	5.6	4.6	4.5	4.8	4.4
Mean daily energy intake (kcal)†	1,737	1,732	1,765	1,816	1,834	1,842	1,939
Physical activity level†,‡	5.5	5.9	6.8	7.6	7.5	7.2	6.8
Family history type 2 diabetes (%)†	23.2	22.9	21.6	21.4	19.9	19.4	16.3
Postmenopausal (%)†	83.9	85.9	84.0	81.8	81.6	81.7	82.6
Higher education (%)†,§	8.2	11.7	16.6	23.7	29.4	29.4	34.8

Data are means ± SD *All characteristics are age-adjusted except age. †*P* value ≤0.001 between alcohol intake categories. ‡Arbitrary units. §Higher education was defined as having finished higher secondary school or completing bachelor's or higher degree.

liquor were separated into three and beer into two categories. Population-attributive risks were calculated according to Rothman and Greenland (14) using teetotalers as a reference group. Two-sided *P* values <0.05 were regarded as significant.

RESULTS

Baseline characteristics

Baseline characteristics of the study population are shown in Table 1. BMI and waist circumference were inversely associated with alcohol consumption, while smoking, energy intake, physical activity level, and education showed positive associations with alcohol consumption. Systolic and diastolic blood pressure and prevalence of hypertension decreased with increasing alcohol consumption up to 140 g/week but increased in the higher drinking categories.

To validate self-reported alcohol intake, we determined the relation between alcohol intake and HDL cholesterol in the random sample of 1,385 women. This analysis showed a linear association ($P < 0.001$) between alcohol intake and HDL cholesterol concentrations (β ± SD: 0.1 ± 0.01 mmol/l per 10 g alcohol/day) with levels ranging from 1.41 ± 0.05 mmol/l among teetotalers to 1.84 ± 0.04 mmol/l among alcohol consumers of ≥210 g/week, adjusted for all confounders from the multivariate model. Lifetime alcohol consumption was also positively associated ($P < 0.001$) with HDL cholesterol (0.03 ± 0.001 per 10 g alcohol/day). When adjusted for baseline alcohol consumption, this association lost significance ($P = 0.31$; 0.01 ± 0.001 per 10 g alcohol/day).

Baseline and lifetime alcohol consumption and type 2 diabetes

During 101,250 person-years of follow-up, 760 new cases of type 2 diabetes were documented. An inverse relation between alcohol intake and risk of type 2 diabetes was observed (Table 2), with a similar risk among teetotalers and women consuming very low amounts of alcohol (0–4.9 g/week). Adjusting for potential confounders, HRs for type 2 diabetes ranging from 0.86 (95% CI 0.66–1.12) for women consuming 5–29.9 g/week to 0.69 (0.47–1.02) for women consuming ≥210 g/week were observed. This equaled a population-attributive risk for type 2 diabetes of 16% for never consuming alcohol. When lifetime alcohol consumption was included in the model the association did not substantially change (Table 2). Waist circumference was a stronger predictor of type 2 diabetes than BMI. When BMI was replaced by waist and hip circumference, the association between alcohol consumption and type 2 diabetes did not substantially alter (data not shown). We also restricted these analyses to cases of type 2 diabetes that reported use of medication or insulin or were confirmed by the medical register, and a similar inverse association between alcohol consumption and type 2 diabetes ($P = 0.004$) with a HR of 0.50 (0.31–0.80) for those consuming ≥140 g alcohol per week was observed.

The association between lifetime alcohol consumption, calculated as alcohol-years, and type 2 diabetes is shown in Table 2. Lifetime alcohol consumption was inversely associated with type 2 diabetes, although more modestly than baseline alcohol consumption. When baseline alcohol consumption was included in the model, the association between lifetime alcohol consumption and type 2 diabetes changed to a U shape. Women with 0.1–4.9 alcohol-years (1.14 [0.87–1.51]) or with ≥50 alcohol-years (1.09 [0.73–1.64]) had a slightly increased risk of type 2 diabetes, while women with 10–20 alcohol-years had an HR of 0.78 (0.59–1.03). Altogether, this equaled a population-attributive risk for type 2 diabetes of 3.5% for never consuming alcohol. Replacing BMI with waist and hip circumference in the model did not alter the observed associations (data not shown).

Table 2—*Baseline and lifetime alcohol consumption and risk of type 2 diabetes among 16,330 women*

		Alcohol consumption		
Baseline alcohol consumption (g/day)	0 (teetotaler)	0–4.9	5.0–29.9	30.0–69.9
Cases (*n*)	100	211	174	87
Person-years	9,297	19,533	23,755	16,015
Age and BMI adjusted	1.0	1.05 (0.83–1.33)	0.79 (0.61–1.01)	0.65 (0.49–0.87)
Multivariate adjusted*	1.0	1.04 (0.80–1.34)	0.86 (0.66–1.12)	0.66 (0.48–0.91)
Multivariate adjusted†	1.0	1.02 (0.79–1.32)	0.85 (0.65–1.11)	0.64 (0.46–0.89)
Lifetime alcohol consumption (alcohol-years)‡	0 (teetotaler)	0–4.9	5.0–9.9	10.0–19.9
Cases (*n*)	101	120	132	137
Person-years	9,492	11,362	15,594	22,200
Age and BMI adjusted	1.0	1.06 (0.82–1.39)	0.92 (0.71–1.19)	0.70 (0.54–0.91)
Age, BMI, and alcohol adjusted	1.0	1.06 (0.82–1.39)	0.93 (0.72–1.21)	0.73 (0.56–0.95)
Multivariate adjusted*	1.0	1.14 (0.86–1.50)	0.96 (0.72–1.26)	0.75 (0.56–0.98)
Multivariate and alcohol adjusted§	1.0	1.14 (0.87–1.51)	0.97 (0.74–1.28)	0.78 (0.59–1.03)

Data are HR (95% CI), unless otherwise indicated. *Adjusted for age, BMI, smoking status, education, systolic blood pressure, menopause, physical activity, family history of type 2 diabetes, daily energy intake, and hypertension. †Adjusted for alcohol-years (continuous) and age, BMI, smoking status, education, systolic blood pressure, menopause, physical activity, family history of type 2 diabetes, daily energy intake, and hypertension. ‡Number of years consuming one standard alcoholic beverage of 10 g alcohol daily. §Adjusted for baseline alcohol consumption (continuous) and age, BMI, smoking status, education, systolic blood pressure, menopause, physical activity, family history of type 2 diabetes, daily energy intake, and hypertension.

Beverage type and type 2 diabetes

Associations between individual alcoholic beverages and type 2 diabetes are shown in Table 3. For consumption of wine only, we observed an inverse association ($P = 0.05$) with type 2 diabetes with a HR of 0.66 (0.40–1.10) for those consuming ≥140 g alcohol/week. Although for the other beverages light to moderate consumption (0.8–69.9 g/week) was also associated with decreased HRs for type 2 diabetes, these associations were not statistically significant.

CONCLUSIONS — In this cohort of older women, a linear inverse association between moderate alcohol consumption and risk of type 2 diabetes was observed. A similar linear inverse association was observed for lifetime alcohol consumption. However, when adjusted for current alcohol consumption, the association changed into a U shape. Beverage type did not influence the association between alcohol consumption and type 2 diabetes.

Certain potential limitations of the study need to be addressed. First, the use of self-reported information on alcohol intake may have introduced misclassification in exposure. However, self-reported alcohol consumption was validated against HDL cholesterol in a random sample of 1,385 women and was positively, linearly associated with HDL cholesterol after adjustment for potential confounders. The assessment of alcohol consumption with the FFQ was also validated against 12- to 24-h recalls, and both measures were highly correlated, showing that this assessment is valid to rank subjects according to their alcohol intake. Altogether, this makes substantial misclassification unlikely. Also, drinking frequency was not included in our questionnaires, and we could thus not assess the influence of binge drinking. However, among moderately drinking older women, binge drinking does not occur frequently (15). It is therefore unlikely that this influenced our results to a large extent.

Second, data on development of type 2 diabetes were partly based on self-reported values and a urine dipstick test. It seems likely that certain cases of type 2 diabetes remained unidentified, because response rates were not complete. However, assuming that the observed relation between alcohol consumption and type 2 diabetes is a true association, such underreporting of type 2 diabetes would only have attenuated the association. Indeed, when restricting our analyses to clinically confirmed cases of diabetes, we observed a similar association with type 2 diabetes.

Lastly, we cannot exclude that residual confounding from other comorbidities such as cardiovascular disease may be present. However, when excluding cases with cardiovascular disease from the analysis, similar results were obtained (data not shown).

This finding of a decreased risk of type 2 diabetes with moderate alcohol consumption is consistent with other reports from prospective studies (2) and expands this relation to older women and lifetime alcohol consumption. In two small studies among women, light drinking was modestly inversely associated with risk of type 2 diabetes, but the findings were not significant (16,17). A larger study of Stampfer et al. (18) also reported nonsignificant results. Lee et al. (5) reported an inverse association between alcohol consumption and type 2 diabetes in the Iowa Women's Health Study. Two recent studies in a large population of younger women also show a decreased risk of type 2 diabetes with alcohol consumption up to levels of 29.9 g/day and 10 g/day (3,4). Beyond these drinking levels, risk of type 2 diabetes increased compared with light to moderate drinking. Similarly, several studies in male populations also indicated heavy drinking as a risk factor for type 2 diabetes (16,17,19), and a recent meta-analysis concluded that alcohol consumption is associated with type 2 diabetes in a U-shaped fashion (2). In contrast, we did not find an increased HR for heavier drinkers using baseline alcohol consumption.

Lifetime alcohol consumption, however, did show a U-shaped association with risk of type 2 diabetes. To the best of our knowledge, this was the first study to report on lifetime alcohol consumption and risk of type 2 diabetes. When adjusted for current alcohol use, we observed that both heavier drinkers and very light drinkers (0.1–4.9 alcohol-years) had a slightly increased risk of type 2 diabetes, while moderate drinkers had a decreased risk of type 2 diabetes.

Table 2—*Continued*

Alcohol consumption			*P* value linear trend	*P* value quadratic trend
70.0–139.9	140.0–209.9	≥210		
92	53	43		
14,643	10,009	7,998		
0.82 (0.62–1.09)	0.68 (0.48–0.95)	0.69 (0.48–0.98)	0.007	0.06
0.91 (0.67–1.24)	0.64 (0.44–0.93)	0.69 (0.47–1.02)	0.007	0.25
0.88 (0.63–1.23)	0.61 (0.41–0.92)	0.65 (0.42–1.01)	0.014	0.25
20.0–29.9	30.0–49.9	≥50		
75	90	91		
12,471	14,882	14,104		
0.76 (0.56–1.02)	0.76 (0.57–1.02)	0.79 (0.60–1.05)	0.003	0.10
0.82 (0.60–1.12)	0.89 (0.64–1.22)	1.04 (0.71–1.54)	0.006	0.02
0.78 (0.56–1.08)	0.87 (0.57–1.06)	0.80 (0.59–1.10)	0.007	0.26
0.86 (0.61–1.20)	0.91 (0.65–1.28)	1.09 (0.73–1.64)	0.024	0.05

Few studies explored the influence of beverage type on risk of type 2 diabetes. Wannamethee et al. (4) reported that the reduction in risk associated with light and moderate drinking was more apparent among beer and wine drinkers. The Atherosclerosis Risk in Communities study also showed no benefit of moderate drinking for liquor drinkers (19). A report from the Health Professionals' Study, in contrast, observed benefit of light to moderate alcohol consumption for all beverage types (20). Consistent with Wannamethee et al. (4), we observed a significant, inverse association only for consumption of wine. However, the other beverages showed similar HRs for type 2 diabetes. Because wine was the predominant beverage type in this population, these differences are probably due to limited power for the other beverages.

The observed relation between alcohol consumption and type 2 diabetes is compatible with a population-attributive risk of 16% for not consuming alcohol. This figure is in accordance with a recent study of Knoops et al. (21) that reported similar population-attributive risks ranging from 13 to 20% for (combinations of) several lifestyle factors such as moderate alcohol consumption, physical activity, or a Mediterranean diet.

This protective effect of moderate alcohol consumption for type 2 diabetes may be due to increased insulin sensitivity with moderate alcohol consumption (22,23). Davies et al. (22) showed that moderate alcohol consumption increased insulin sensitivity dose dependently in postmenopausal women after 8 weeks of consumption of 0, 15, or 30 g alcohol per day. Anti-inflammatory effects (24) of moderate alcohol consumption may also be involved in this risk reduction. In this study, moderate alcohol consumption was associated with decreased BMI and waist circumference. Therefore, BMI or waist circumference may also mediate the association with type 2 diabetes, but we could not find evidence for this in our study.

In conclusion, this study supports the view that moderate alcohol consumption decreases risk of type 2 diabetes in older

Table 3—*Beverage type and risk of type 2 diabetes among 16,330 women*

	Alcohol consumption (g/day)					*P* value
	0–0.7	0.8–29.9	30.0–69.9	70–139.9	≥140	linear trend
Wine						
Cases (*n*)	212	314	69	45	19	
Person-years	20,236	44,496	14,760	8,097	4,324	
Multivariate-adjusted HR*	1.0	0.95 (0.78–1.15)	0.73 (0.54–0.99)	0.92 (0.64–1.32)	0.66 (0.40–1.10)	0.05
Fortified wine						
Cases (*n*)	359	202	31	67		
Person-years	43,960	31,163	5,488	11,302		
Multivariate-adjusted HR*	1.0	0.96 (0.80–1.16)	0.88 (0.59–1.31)	0.88 (0.66–1.16)		0.81
Beer						
Cases (*n*)	531	111	17			
Person-years	70,077	19,014	2,822			
Multivariate-adjusted HR*	1.0	1.02 (0.81–1.27)	0.86 (0.50–1.48)			0.72
Liquor						
Cases (*n*)	453	144	25	39		
Person-years	57,767	26,664	2,863	4,619		
Multivariate-adjusted HR*	1.0	0.80 (0.65–0.98)	1.16 (0.75–1.80)	1.07 (0.76–1.51)		0.26

Data are HR (95% CI), unless otherwise indicated. *Adjusted for age, BMI, smoking status, education, systolic blood pressure, menopause, physical activity, family history of type 2 diabetes, daily energy intake, and hypertension.

women. Both current and lifetime alcohol consumption were associated with a decreased risk of type 2 diabetes. These data agree with previous observations and expand this evidence to older women and lifetime alcohol consumption.

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