Coffee Consumption and Risk of Cardiovascular Diseases and All-Cause Mortality Among Men With Type 2 Diabetes

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OBJECTIVE — Coffee consumption has been linked to detrimental acute metabolic and hemodynamic effects. We investigated coffee consumption in relation to risk of CVDs and mortality in diabetic men.

RESEARCH DESIGN AND METHODS — We conducted a prospective cohort study including 3,497 diabetic men without CVD at baseline.

RESULTS — After adjustment for age, smoking, and other cardiovascular risk factors, relative risks (RRs) were 0.88 (95% CI 0.50–1.57) for CVDs (*P* for trend = 0.29) and 0.80 (0.41–1.54) for all-cause mortality (*P* for trend = 0.45) for the consumption of ≥4 cups/day of caffeinated coffee compared with those for non–coffee drinkers. Stratification by smoking and duration of diabetes yielded similar results. RRs for caffeine intake for the highest compared with the lowest quintile were 1.02 (0.70–1.47; *P* for trend = 0.96) for CVDs and 0.96 (0.64–1.44; *P* for trend = 0.69) for mortality.

CONCLUSIONS — These data indicate that regular coffee consumption is not associated with increased risk for CVDs or mortality in diabetic men.

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Coffee drinking is widespread across the world and has been linked with both beneficial and harmful effects on biological markers of cardiovascular disease (CVD) (1). Recently, caffeine has been reported to have acute detrimental effects on glucose tolerance in diabetes (2). Whereas most prospective studies have suggested that coffee consumption is not associated with increased risk for CVD in general population (3,4), data among diabetes are sparse (5). Therefore, we prospectively examined the relationship between coffee and coronary heart disease (CHD), stroke, and mortality among men with type 2 diabetes in the Health Professionals Follow-up Study (HPFS).

RESEARCH DESIGN AND METHODS

— The HPFS is a prospective cohort study of 51,529 male health professionals aged 40–75 years in 1986. In this study, after excluding participants with CVDs or cancer at baseline, 3,497 men remained who reported a diagnosis of type 2 diabetes on any questionnaire from 1986 to 2004.

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Assessment of coffee consumption

Coffee intake was assessed using a semiquantitative frequency questionnaire sent to the participants in 1986, 1990, 1994, 1998, and 2002. The validity and reliability of the frequency questionnaire has previously been described (6). We also assessed total caffeine intake (7).

Ascertainment of end points

The end points were incident CHD (defined as nonfatal myocardial infarction or fatal CHD), stroke, and mortality. The diagnosis of outcomes has previously been described (4). Briefly, myocardial infarction was confirmed if it met the criteria of the World Health Organization of symptoms and the patient's records showed diagnostic electrocardiographic changes or elevated cardiac enzyme levels. Stroke was confirmed by medical records according to the criteria of the National Survey of Stroke, which define it as a constellation of neurological deficits, sudden or rapid in onset, lasting at least 24 h or until death. Deaths were reported by next of kin or the postal system or ascertained through the National Death Index.

Statistical analysis

Cox proportional hazards regression was used to investigate the association between coffee consumption and incidence of cardiovascular events and all-cause mortality. Multivariable models were adjusted for age, smoking status, BMI, physical activity, alcohol intake, parental history of myocardial infarction, hypertension, hypercholesterolemia, duration of diabetes, hypoglycemic therapy, and dietary factors (total energy intake; use of multivitamin and vitamin E supplements; polyunsaturated, saturated, and *trans* fat intake; glycemic load; and cereal fiber and folate intake) using categorical variables. The median value of each category of coffee consumption was modeled as a continuous variable to test for linear trends. All analyses were performed with SAS software (version 8.2; SAS Institute, Cary, NC).

Table 1—*RRs (95% CI) for CVDs and total mortality by caffeinated coffee consumption and total caffeine intake among men with type 2 diabetes (1986–2004)*

	Caffeinated coffee consumption (cups)					
	<1/month	1/month–4/week	5–7/week	2–3/day	≥4/day	*P* for trend
Total cardiovascular events						
Person-years	5,489	5,184	7,250	4,855	1,289	
n	110	90	144	72	19	
Age and smoking adjusted	1.0	0.83 (0.63–1.01)	0.95 (0.74–1.22)	0.73 (0.54–0.98)	0.71 (0.43–1.17)	0.07
Multivariable I†	1.0	0.72 (0.53–1.00)	0.94 (0.70–1.26)	0.65 (0.45–0.92)	0.86 (0.50–1.50)	0.27
Multivariable II‡	1.0	0.77 (0.53–1.10)	0.93 (0.67–1.28)	0.66 (0.45–0.97)	0.88 (0.50–1.57)	0.29
CHD						
n	86	64	106	54	14	
Age and smoking adjusted	1.0	0.75 (0.54–1.04)	0.88 (0.66–1.18)	0.70 (0.49–0.98)	0.67 (0.37–1.18)	0.11
Multivariable I†	1.0	0.61 (0.41–0.89)	0.89 (0.63–1.24)	0.60 (0.40–0.91)	0.73 (0.38–1.42)	0.26
Multivariable II‡	1.0	0.63 (0.41–0.97)	0.90 (0.62–1.31)	0.66 (0.42–1.02)	0.81 (0.41–1.62)	0.45
Stroke						
n	24	26	38	18	5	
Age and smoking adjusted	1.0	1.12 (0.64–1.96)	1.20 (0.72–2.02)	0.83 (0.45–1.54)	0.88 (0.33–2.35)	0.42
Multivariable I†	1.0	1.16 (0.62–2.17)	1.16 (0.63–2.13)	0.78 (0.37–1.64)	1.34 (0.48–3.78)	0.75
Multivariable II‡	1.0	1.15 (0.58–2.27)	0.97 (0.51–1.86)	0.63 (0.29–1.36)	0.97 (0.33–2.85)	0.31
All-cause mortality						
Person-years	5,555	5,240	7,334	4,901	1,301	
Deaths (*n*)	127	115	173	98	25	
Age and smoking adjusted	1.0	0.90 (0.70–1.16)	0.92 (0.73–1.16)	0.90 (0.69–1.17)	0.86 (0.56–1.33)	0.52
Multivariable I†	1.0	0.76 (0.55–1.06)	0.96 (0.71–1.30)	0.72 (0.50–1.04)	0.72 (0.39–1.31)	0.24
Multivariable II‡	1.0	0.69 (0.47–1.02)	0.89 (0.63–1.26)	0.71 (0.47–1.06)	0.80 (0.41–1.54)	0.45
	Quintiles of caffeine intake (mg/day)					*P* for trend
	<110	110–203	204–316	317–450	>450	
Median intake (mg/day)	48	160	238	379	724	
Total CVD events						
Person-years	4,768	4,835	4,801	4,845	4,818	
n	90	84	104	75	82	
Age and smoking adjusted	1.0	0.94 (0.70–1.27)	1.17 (0.88–1.55)	0.85 (0.62–1.15)	0.96 (0.71–1.30)	0.51
Multivariable I†	1.0	0.92 (0.65–1.29)	1.11 (0.80–1.54)	0.86 (0.60–1.23)	1.00 (0.71–1.42)	0.90
Multivariable II§	1.0	0.88 (0.61–1.27)	1.08 (0.76–1.54)	0.84 (0.57–1.23)	1.02 (0.70–1.47)	0.96
CHD						
n	67	62	76	55	64	
Age and smoking adjusted	1.0	0.92 (0.65–1.30)	1.13 (0.81–1.58)	0.82 (0.57–1.18)	1.00 (0.71–1.42)	0.79
Multivariable I†	1.0	0.88 (0.59–1.31)	1.03 (0.70–1.52)	0.82 (0.54–1.24)	0.98 (0.66–1.47)	0.91
Multivariable II§	1.0	0.85 (0.55–1.32)	1.07 (0.70–1.62)	0.83 (0.53–1.31)	1.03 (0.67–1.59)	0.85
Stroke						
n	23	22	28	20	18	
Age and smoking adjusted	1.0	1.01 (0.56–1.82)	1.28 (0.73–2.23)	0.93 (0.51–1.70)	0.82 (0.44–1.54)	0.38
Multivariable I†	1.0	1.04 (0.53–2.03)	1.36 (0.71–2.59)	1.00 (0.49–2.02)	1.04 (0.51–2.11)	0.92
Multivariable II§	1.0	0.97 (0.48–1.94)	1.17 (0.60–2.30)	0.84 (0.41–1.77)	0.94 (0.46–1.95)	0.73
All-cause mortality						
Person-years	4,826	4,887	4,858	4,882	4,877	
n	112	100	138	95	93	
Age and smoking adjusted	1.0	0.91 (0.69–1.19)	1.22 (0.95–1.57)	0.86 (0.65–1.13)	0.94 (0.71–1.24)	0.40
Multivariable I†	1.0	0.91 (0.65–1.29)	1.23 (0.89–1.71)	0.93 (0.65–1.32)	0.80 (0.55–1.16)	0.17
Multivariable II§	1.0	0.93 (0.63–1.38)	1.30 (0.90–1.87)	0.94 (0.63–1.41)	0.96 (0.64–1.45)	0.70

†Adjusted for age (5-year categories), smoking status (never, past, or current at 1–14 or ≥15 cigarettes/day), BMI (<23.0, 23.0–24.9, 25.0–29.9, or ≥30.0 kg/m^2), alcohol intake (0, 0.1–4.9, 5.0–14.9, or ≥15 g/day), parental history of myocardial infarction, history of hypertension, hypercholesterolemia, physical activities (quintiles of METs/week), duration of diabetes (<5, 5–10, or ≥10 years), and hypoglycemic medication (yes or no). ‡Adjusted for the variables cited for model I and dietary factors, including total energy intake; multivitamin use and vitamin E supplement use; intake of polyunsaturated, saturated, and *trans* fat; long-chain n-3 fatty acids; cereal fiber; folate; glycemic load (all in quintiles); and decaffeinated coffee and tea consumption. §Adjusted for the variables cited above except for decaffeinated coffee and tea consumption.

RESULTS — Between 1986 and 2004 (24,121 person-years of follow-up), we documented 435 cases of incident CVD (324 CHD and 111 stroke) and 538 deaths from all causes (215 from CHD or stroke, 145 from cancer, and 178 from other causes).

In both age- and smoking-adjusted analyses and multivariable analyses adjusting for lifestyle and other cardiovascular risk factors, we observed no association between caffeinated coffee consumption and a higher risk of CHD, stroke, or all-cause mortality (Table 1). Additional adjustment for dietary factors did not substantially change the results. Similarly, caffeinated coffee consumption was not associated with risk of cardiovascular death (relative risks [RRs] 0.64 [95% CI 0.35–1.17] for once per month to four times per week, 0.84 [0.49–1.44] for five to seven times per week, and 0.58 [0.31–1.10] for two or more cups per day compared with the risks for those who did not consume caffeinated coffee; *P* for trend = 0.26). Caffeine intake was not substantially associated with CVD or mortality (Table 1). We also examined decaffeinated coffee consumption in relation to risk for CVD and mortality and did not observe significant associations (data not shown).

Stratified analyses showed no direct association between coffee consumption and CVD risk in any subgroups by risk factor status, including overweight, smoking status, duration of diabetes, hypertension, parental history of myocardial infarction, and aspirin use (supplemental Table 1, available in the online appendix [http://care.diabetesjournals.org/cgi/content/full/dc08-2251/DC1]).

CONCLUSIONS — In this prospective study in diabetic men, higher habitual coffee consumption was not associated with a higher risk of CVD or all-cause mortality. We did not find significant associations for decaffeinated coffee or total caffeine intake either.

Coffee is a major source of caffeine. Several studies showed that caffeine acutely impaired postprandial glucose metabolism in diabetic patients (8,9). In addition, concerns have been raised in short-term trials that caffeine increases blood pressure (10) and homocysteine levels (11). However, findings from short-term caffeine intervention studies cannot be extrapolated to the effects of chronic coffee consumption on risk of CVD. First, physiological effects of coffee can be different from those of caffeine. It has been shown that caffeine results in a larger increase in epinephrine concentrations than intake of the same amount of caffeine in coffee (12). Moreover, coffee contains various substances such as antioxidants (i.e., chlorogenic acid) that may improve glucose metabolism and insulin sensitivity (13). Second, the acute effects of caffeine could be transient because partial tolerance to the humoral and hemodynamic effects of caffeine among habitual drinkers might develop after several days of use (14).

In this study, the availability of updated measures of coffee and covariates during the follow-up enabled us to incorporate changes in coffee consumption into the analysis. Because coffee drinking is often thought to be an unhealthy habit, people may quit or reduce the consumption of coffee to improve their health after developing hypertension or hypercholesterolemia. These changes would dilute a possible positive association between coffee and CHD or stroke. To reduce this bias, we excluded subjects with hypertension or hypercholesterolemia at baseline. We also conducted a sensitivity analysis where we used short-term caffeinated coffee consumption in relation to CVD and mortality, which yielded very similar results. As illustrated by the upper limits of 95% CIs of our RR estimates, we cannot exclude the possibility that we missed an association between coffee consumption and a modestly higher risk of CVD due to chance. However, results from a previous study in Finnish individuals with diabetes support the lack of a direct association and even suggest an inverse association between coffee and CVD mortality (5).

In conclusion, in this large prospective study of U.S. men, our findings do not support the hypothesis that habitual caffeinated coffee consumption increases risk of cardiovascular events or mortality among individuals with type 2 diabetes.

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No potential conflicts of interest relevant to this article were reported.

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