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Arterioscler Thromb Vasc Biol 2008;28;1018-1023; originally published online Mar 6, 2008;

DOI: 10.1161/ATVBAHA.107.160457

Arteriosclerosis, Thrombosis, and Vascular Biology is published by the American Heart Association. 7272 Greenville Avenue, Dallas, TX 72514

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Background—The role of coffee in the cardiovascular system is not yet clear. We examined the relation of coffee intake with coronary calcification in a population-based cohort.

Methods and Results—The study involved 1570 older men and women without coronary heart disease who participated in the Rotterdam Study. Coffee intake was assessed with a semiquantitative food frequency questionnaire. Coronary calcification was detected with electron beam computed tomography. Severe calcification was defined as an Agatson calcium score >400. Sex-specific odds ratios (ORs) with 95% confidence intervals (95% CI) were obtained by logistic regression with adjustment for age, smoking, body mass index, education, and intake of energy and alcohol. In multivariable analysis, coronary calcification in women was significantly reduced for moderate (>3 to 4 cups) and high (>4 cups) coffee intake, compared with a daily intake of 3 cups or less (OR of 0.41 [95% CI: 0.25 to 0.65] and 0.54 [0.33 to 0.87], respectively). The association persisted after additional adjustment for tea and other dietary confounders, and was not modified by smoking. A nonsignificant inverse relationship was also found in men who smoked, whereas in nonsmoking men a direct association was observed.

Conclusion—The present study suggests a beneficial effect of coffee drinking against coronary calcification, particularly in women. More research is needed to confirm these findings and to clarify possible effect modification by gender and smoking. (***Arterioscler Thromb Vasc Biol* 2008;28:1018-1023**)

Key Words: coffee ■ coronary calcification ■ population-based study ■ electron-beam computed tomography ■ coronary heart disease

Dietary and lifestyle factors are implicated in the etiology of coronary heart disease (CHD).[1] Coffee is an important dietary factor, because it is one of the most widely used pharmacologically active beverages. The relation between coffee consumption and CHD is not unambiguous. Studies showed a significant positive association,[2,3] no association,[3–7] or even an inverse association[8,9] between coffee consumption and CHD. The effect of filtered coffee on serum lipids[10] and blood pressure is small.[11–13] Recent findings showed that coffee consumption may protect against diabetes mellitus and improve insulin sensitivity.[14–16] Part of the beneficial effects of coffee on the cardiovascular system may be attributable to the antioxidant activity of polyphenols in coffee or minerals such as potassium and magnesium.[17]

Although coffee consumption has been studied in the relation to various risk factors of CHD, it has not yet been examined in the relation to atherosclerosis. An accurate noninvasive measurement for atherosclerosis in the coronary arteries is coronary calcification assessed by electron beam tomography (EBT), because it is closely related to the amount of atherosclerotic plaque.[18] Coronary calcification has been found to predict risk of CHD.[19] Oei et al showed in 2013 participants of the Rotterdam Coronary Calcification Study that cardiovascular risk factors assessed 7 years before EBT scanning are strongly associated with coronary calcification.[20] We examined whether habitual coffee drinking was associated with coronary calcification in this older Dutch population.

Methods

Study Population

The Rotterdam Study is a population-based follow-up study with baseline examinations conducted between 1990 and 1993. All inhabitants of a suburb of Rotterdam, aged 55 years and over, were invited. In total 7983 men and women agreed to participate. Follow-up visits took place in 1993 to 1994 and 1997 to 1999. The aim of the Rotterdam Study is to assess the occurrence of chronic diseases in an ageing population and to clarify their determinants. The rationale and design of the Rotterdam Study have been described elsewhere.[21]

The present analysis formed part of the Rotterdam Coronary Calcification Study, which is embedded in the Rotterdam Study.[20] The Rotterdam Coronary Calcification Study was designed to study the determinants and consequences of coronary calcification detected

Original received December 3, 2007; final version accepted February 25, 2008.

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Arterioscler Thromb Vasc Biol **is available at http://atvb.ahajournals.org** **DOI: 10.1161/ATVBAHA.107.160457**

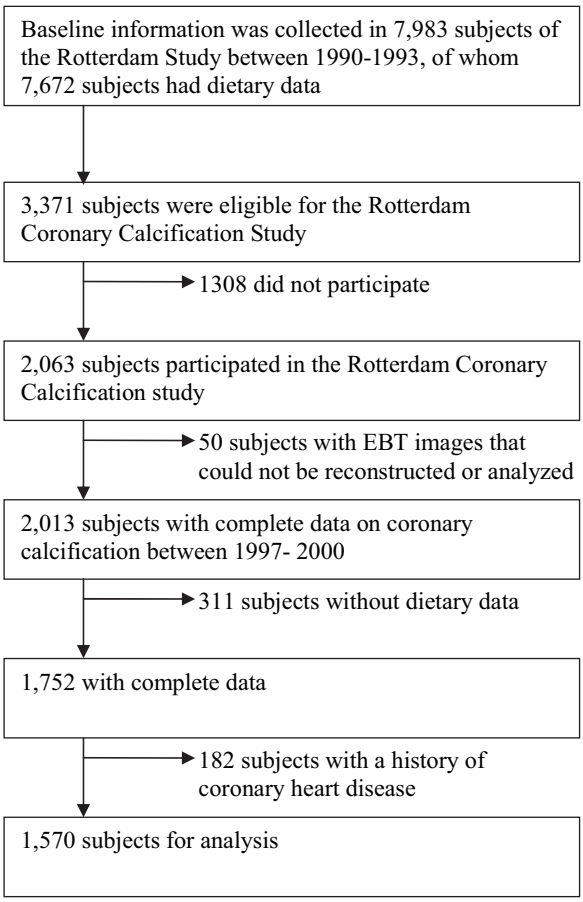

Figure. Flow diagram for the selection of subjects for the analysis of coffee intake and coronary calcification in the Rotterdam Study.

by EBT. From 1997 to 2000, noninstitutionalized participants of the Rotterdam Study who were below 86 years of age were invited to undergo an EBT scan. Scans were obtained for 2063 (response 61%) of the 3370 eligible individuals. Because of several causes, ie, metal clips from cardiac surgery, severe artifacts, registration errors, and errors pertaining to electrocardiography or image acquisition, data could not be reconstructed or analyzed in 50 subjects. Consequently, data were available for 2013 participants. We excluded 311 participants, because data on coffee consumption were missing. From the 1702 participants left, 182 participants with a history of CHD (ie, angina pectoris, myocardial infarction, coronary bypass surgery, or percutaneous transluminal coronary angiography) were excluded from the data analysis. Eventually, the analysis was based on 1570 participants (Figure). The Medical Ethics Committee of Erasmus University, the Netherlands, approved the study. All participants gave informed consent.

Dietary Intake

Dietary data was collected during the baseline visit between 1990 and 1993. Before the baseline center visits, the participants received a checklist on which they indicated all foods and drinks that they consumed more than once a month during the preceding year. At baseline a trained dietician interviewed the participants at the study center, using a validated semiquantitative food frequency questionnaire.[22] The aim of this interview was to obtain accurate information on amount and consumption frequency of food items noted by participants as consumed frequently in the completed checklist. Two-thirds of the dietary interviews were performed using a computer program that verified all data simultaneously. The questionnaire comprised 170 food items and all relevant beverages, including coffee. Participants reported their habitual coffee intake as number of cups per day or week. One cup of coffee was considered equal to 125 mL.

Measurement of Cardiovascular Risk Factors

Information on smoking was obtained at baseline during the home interview. We categorized subjects as present, past, or never smokers. Anthropometric measures were obtained during the visit to the research center. Blood pressure was measured at the right brachial artery with a random-zero sphygmomanometer with the participant in the sitting position. The mean of 2 consecutive measurements was used. Hypertension was defined as a systolic blood pressure of $\geq$140 mm Hg, diastolic blood pressure of $\geq$90 mm Hg, or use of blood pressure-lowering medication for the indication hypertension. After an overnight fast, blood samples were obtained at the research center. Serum total cholesterol was determined by an automated enzymatic procedure using the Roche CHOD-PAP reagent agent, and HDL was measured with the Roche HDL cholesterol assay using polyethylene glycol (PEG)-modified enzymes and dextran sulfate. Glucose was determined enzymatically by the Hexokinase method. Diabetes mellitus was considered present when subjects used antidiabetic medication or when random or postload serum glucose levels were $\geq$220 mg/dL (ie, 11.1 mmol/L) at baseline.

Coronary Calcification

In this study EBT scans were used to assess coronary calcifications in the epicardial coronary arteries. All scans were performed with a C-150 Imatron scanner (GE-Imatron) by trained technicians, who were blinded to the clinical data of the participants. The scanner was calibrated on a daily basis using a water phantom.

From the level of the root of the aorta through the heart, 38 images were obtained with 100 ms scan time and 3 mm slice thickness. Images at 80% of the cardiac cycle were acquired using ECG triggering during a single breath-holding period (20 to 40 seconds depending on heart rate). Before the participants were scanned, they performed adequate breath-holding exercises. Quantification of coronary calcifications was performed with AccuImage software (AccuImage Diagnostics Corporation). This software displayed all pixels with a density greater than 130 Hounsfield units (HUs). The presence of calcification was defined as a minimum of 2 adjacent pixels (area=0.65 mm^2) with a density greater than 130 HUs. A region of interest was placed around each high-density lesion in the epicardial coronary arteries, ensuring that the complete calcified lesion was incorporated in the region of interest. Calcium scores were obtained as proposed by Agatston et al.[23] In this scoring method, the area in mm^2 of individual calcified lesions is multiplied by a factor based on the maximum density of the lesion. This factor ranges from 1 to 4 in the following manner: 1=130 to 199 HU; 2=200 to 299 HU; 3=300 to 399 HU; and 4=400 HU or greater. The total calcium score for the entire epicardial coronary system is the sum of the scores for all individual lesions. Severe coronary calcification was defined as a coronary calcium score greater than 400, according to Rumberger et al.[18]

Statistical Analysis

Daily coffee consumption was divided into 3 categories, namely low ($\leq$3 cups), moderate (>3 to 4 cups), and high (>4 cups). Calcium scores were divided into 2 categories, namely nonsevere ($\leq$400) and severe (>400) coronary calcification. Medians with 25th and 75th percentiles are reported for calcium score, and intake of alcohol, milk, and fruit, because of skewed data. Other descriptive data are presented as means$\pm$SD or percentages.

The association between severe coronary calcification and categories of coffee intake was assessed with multivariable logistic regression. The dichotomized calcium score was used as the dependent variable. Odds ratios (ORs) with corresponding 95% confidence interval (CI) were obtained. The reference category comprised coffee intakes $\leq$3 cups per day. The analyses were performed for men and women separately. In the first model, we only adjusted for age. A second model was additionally adjusted for cigarette smoking status (present, former, never), body mass index (BMI) (kg/m^2), level of education (3 categories), energy intake (kJ/d), and alcohol consumption (g/d). Thirdly, the analysis was repeated with the additional

adjustment for intake of tea (mL/d), fruit (g/d), meat (g/d), and saturated fatty acids (SFA) (g/d).

Diabetes mellitus (yes/no), hypertension (yes/no), total serum cholesterol (mmol/L), and serum HDL (mmol/L) level were added to the multivariable model one at a time to study whether these parameters could be intermediary factors in the relation of coffee drinking with coronary calcification, and changes in ORs were examined. In multivariable analysis we imputed population means for missing data on systolic blood pressure (0.5% of the population), diastolic blood pressure (0.5%), smoking status (0.6%), and total serum cholesterol (0.5%). Missing data on HDL cholesterol (0.8%) and BMI (0.5%) were replaced by sex-specific means. A linear test for trends across categories was performed by entering the median values of each coffee category into the models. To evaluate confounding by smoking, stratified analysis was conducted in present and nonsmokers (former and never combined). Statistical analyses were done using the statistical software program SPSS 12.0.1 for Windows. For all analyses a 2-sided probability value less than 0.05 was considered statistically significant.

Results

General characteristics of the participants obtained between 1990 to 1993 are shown in Table 1. Subjects were on average 64 years old, and 56% were women. Of men, 28% smoked whereas this was 19% in women. Most subjects were alcohol consumers, but habitual intake was lower in women than in men (4 versus 14 g/d, respectively). The proportion of coffee drinkers was high (98%) both in men and women, but the average daily coffee consumption was higher in men than women (≈5 versus ≈4 cups/d, respectively). Coffee was inversely correlated with tea intake both in men and women after adjustment for age ($r=-0.23$ and -0.28, respectively, $P<0.001$). The median period between baseline and EBT measurement was 7.0 (SD 1.2) years. The prevalence of severe coronary calcification was 39% in men, compared to 18% in women ($P<0.001$). The median calcium score in men (235) was almost equal to the 75th quartile calcium score in women (236). Within the group of subjects with severe coronary calcification (score >400), men also had more calcium deposits than women (median scores: 918 versus 781). This was also the case for the reference group (score ≤400; median scores of 73 in men versus 23 in women).

Tables 2 and 3 show ORs of severe coronary calcification by coffee consumption in men and women, respectively. In men, coffee intake was not significantly related to severe calcification. In women, we observed an inverse association of coffee intake with severe calcification (ORs of 0.45 for 3 to 4 cups and 0.75 for >4 cups, compared ≤3 cups per day). ORs were further reduced in the multivariable model, which could mainly be attributed to adjustment for smoking status. (ORs of 0.41, 95% CI [0.25 to 0.65] and 0.54 [0.33 to 0.87], respectively; model 3). In posthoc analyses, additional adjustment for pack-years of smoking, female hormones use (ever/never), milk consumption (mL/d), or fish consumption (g/d) did not substantially change the results (data not presented). When we performed an additional analysis in women with ≤2 cups of coffee per day as the reference group, ORs of 0.98 (0.56 to 1.73), 0.40 (0.24 to 0.68), and 0.53 (0.31 to 0.92) were obtained for coffee intake of >2 to 3, >3 to 4, >4 cups per day, respectively. Similar analysis in men resulted in ORs of 0.78 (0.42 to 1.44), 1.01 (0.62 to 1.64), and 1.11 (0.68 to 1.70), respectively.

Table 1. Baseline Characteristics of 1570 Older Dutch Men and Women of the Rotterdam Coronary Calcification Study

	Men (n=686)	Women (n=884)
Age, y	64.1±5.4	64.0±5.5
Body Mass Index, kg/m^2*	25.9±2.8	26.4±3.8
Blood pressure, mm Hg*		
Systolic	136.7±20.2	133.7±20.4
Diastolic	75.8±11.1	73.2±10.6
Hypertension, %*†	16.9	12.9
Diabetes mellitus, %*	3.8	3.2
Education level, %‡		
Low	19.1	34.2
Intermediate	58.7	58.8
High	22.2	7.0
Serum lipids, mmol/L*		
Total cholesterol	6.4±1.2	6.9±1.2
HDL cholesterol	1.2±0.4	1.5±0.3
Total/HDL ratio	5.5±1.6	5.0±1.5
Smokers, %*		
Present	28.0	19.0
Pack-years	9.9	5.3
Former	65.3	34.7
Pack-years	18.2	6.1
Never	6.7	46.3
Dietary intake		
Energy, kJ/d	9533±2153	7464±1648
Fruit, g/d§	201 (121 to 276)	231 (155 to 313)
Meat, g/d	130±48	100±43
Milk, mL/d§	349 (204 to 518)	374 (229 to 514)
Saturated fat, g/d	36.2±12.4	28.4±10.2
Alcohol drinkers, %	90.0	80.5
Intake of alcohol, g/d¶	14.4 (4.7 to 28.4)	4.0 (0.9 to 12.6)
Coffee drinkers, %	98.1	97.5
≤3 cups	27.8	37.2
>3 to 4 cups	30.8	32.9
>4 to 5 cups	14.1	10.7
>5 cups	27.3	19.1
Intake of coffee, cups/d¶	4.6±2.1	4.0±1.7
Tea drinkers, %	82.9	87.1
Intake of tea, mL/d¶	363±211	440±230

Values are means±SD or percentages.

*Data were missing for <4% of the subjects.

†Hypertension is defined as systolic blood pressure ≥140 mm Hg or diastolic blood pressure ≥90 mm Hg or treatment with antihypertensive drugs.

‡Low=primary education, intermediate=lower vocational or secondary general or vocational education, high=higher vocational education/university.

§Data expressed as median (interquartile range), because of skewed distributions.

¶In drinkers only.

Table 2. Association of Coffee Intake With Severe Coronary Calcification in 686 Older Dutch Men

	Coffee Intake, Cups/Day			
	≤3 (n=191)	>3 to 4 (n=211)	>4 (n=284)	*P* for Trend
Median coffee intake	2.0	4.0	6.0	
No. of cases	72	85	111	
OR, model 1	1	1.11 (0.74 to 1.67)	1.22 (0.83 to 1.80)	0.32
OR, model 2	1	1.11 (0.73 to 1.67)	1.23 (0.83 to 1.83)	0.30
OR, model 3	1	1.12 (0.74 to 1.70)	1.23 (0.83 to 1.85)	0.30

OR indicates odds ratio for severe calcification with 95% confidence interval.
Model 1: adjusted for age.
Model 2: adjusted for age, smoking, BMI, level of education, energy intake, and alcohol consumption.
Model 3: as model 2 with additional adjustment for intake of tea, fruit, meat, and SFA.

In both men and women, the findings for severe coronary calcification did not significantly change after inclusion of diabetes mellitus, hypertension, total serum cholesterol, or HDL cholesterol (Model 3: ORs ≈1.1 and 1.3 in men and ORs ≈0.4 and 0.5 in women, for 3 to 4 cups and >4 cups respectively, compared ≤3 cups per day). This indicates no strong intermediary roles for these cardiovascular risk factors. Also, exclusion of subjects with zero coffee intake from the reference category yielded roughly similar estimates (Model 3: ORs of 1.13 [0.74 to 1.73] and 1.26 [0.83 to 1.89] in men; ORs of 0.42 [0.26 to 0.68] and 0.56 [0.34 to 0.91] in women, in consecutive coffee categories compared to lowest category). An additional analysis in which we compared daily coffee intake >5 cups (in stead of >4 cups) versus ≤3 cups did not essentially change the results (OR of 1.18 [0.76 to 1.85] in men and OR of 0.51 [0.30 to 0.89] in women). Daily tea intake, which was significantly inversely related to coffee consumption, showed a nonsignificant association with severe coronary calcification both in men (OR=0.98 per 100 mL, $P=0.45$) and women (OR=0.95 per 100 mL, $P=0.15$) in multivariable analysis (model 3).

Table 4 presents the results of the stratified analysis according to smoking status. In women, the inverse association of coffee with severe coronary calcification was observed for both present and nonsmokers (former and never combined). In men, a decreased risk of severe coronary calcification was observed only in smokers, whereas in nonsmokers the opposite was observed at high coffee consumption (OR=1.78 [1.09 to 2.91]).

Discussion

In the present population-based cohort we found an inverse association between coffee consumption and coronary calcification in women, but not in men. This study has several limitations and strengths. Firstly, subjects who drink little or no coffee may differ from habitual coffee drinkers, eg, by having a different lifestyle. However, we adjusted for potential confounding factors, including tea intake and other dietary factors. Furthermore, the exclusion of noncoffee drinkers from the reference group in the data analysis did not change the results. Secondly, potential misclassification of type and amount of coffee intake may have occurred, because intake of coffee was self-reported and only assessed at one moment in time, on average 7 years before the assessment of coronary calcification. Accurate reproducibility and validity of reported coffee intake by means of a food frequency questionnaire has been reported in epidemiological studies, with correlations up to 0.9.[24] Should misclassification of coffee intake have occurred, however, this would have attenuated the observed risk estimates, resulting in bias toward the null. Thirdly, analyses could not be corrected for physical activity. Part of the confounding was removed by correcting the data for total energy intake and other lifestyle factors (such as smoking and education level), which are

Table 3. Association of Coffee Intake With Severe Coronary Calcification in 884 Older Dutch Women

	Coffee Intake, Cups/Day			
	≤3 (n=329)	>3 to 4 (n=291)	>4 (n=264)	*P* for Trend
Median coffee intake	2.0	4.0	6.0	
No. of cases	81	36	44	
OR, model 1	1	0.45 (0.29 to 0.69)*	0.75 (0.49 to 1.14)	0.17
OR, model 2	1	0.43 (0.27 to 0.68)*	0.56 (0.35 to 0.89)#	0.014
OR, model 3	1	0.41 (0.25 to 0.65)*	0.54 (0.33 to 0.87)#	0.011

OR indicates odds ratio for severe calcification with 95% confidence interval.
Model 1: adjusted for age.
Model 2: adjusted for age, smoking, BMI, level of education, energy intake, and alcohol consumption.
Model 3: as model 2 with additional adjustment for intake of tea, fruit, meat, and SFA.
#$P<0.05$; *$P<0.01$.

Table 4. Association of Coffee Intake With Severe Coronary Calcification by Smoking Status in 1570 Older Dutch Men and Women of the Rotterdam Coronary Calcification Study

	Coffee Intake, Cups/Day Men			*P* for Trend	Coffee Intake, Cups/Day Women			*P* for Trend
	≤3	>3 to 4	>4		≤3	>3 to 4	>4	
Current smokers								
No. of subjects	44	48	100		41	47	80	
No. of cases	20	45	6		18	24	37	
OR, model 1	1	0.85 (0.37 to 1.95)	0.57 (0.28 to 1.18)	0.13	1	0.23 (0.09 to 0.65)*	0.51 (0.22 to 1.16)	0.11
OR, model 2	1	0.89 (0.38 to 2.07)	0.61 (0.29 to 1.30)	0.20	1	0.22 (0.07 to 0.65)*	0.36 (0.14 to 0.92)#	0.033
OR, model 3	1	0.90 (0.38 to 2.13)	0.57 (0.26 to 1.25)	0.16	1	0.29 (0.09 to 0.94)#	0.38 (0.14 to 1.05)	0.063
Nonsmokers								
No. of subjects	146	163	182		286	243	181	
No. of cases	52	65	79		63	28	24	
OR, model 1	1	1.23 (0.77 to 1.96)	1.77 (1.10 to 2.84)#	0.018	1	0.49 (0.30 to 0.79)*	0.65 (0.38 to 1.10)	0.11
OR, model 2	1	1.21 (0.75 to 1.95)	1.76 (1.08 to 2.85)#	0.022	1	0.49 (0.29 to 0.80)*	0.61 (0.35 to 1.05)	0.076
OR, model 3	1	1.22 (0.75 to 1.97)	1.78 (1.09 to 2.91)#	0.022	1	0.44 (0.26 to 0.74)*	0.56 (0.31 to 0.98)#	0.043

OR indicates odds ratio for severe calcification with 95% confidence interval.
Model 1: adjusted for age.
Model 2: adjusted for age, BMI, level of education, energy intake, and alcohol consumption.
Model 3: as model 2 with additional adjustment for intake of tea, fruit, meat, and saturated fat.
#$P<0.05$; *$P<0.01$.

related to physical activity. Had residual confounding remained, it would have resulted in attenuated risk estimates in women because high intake of coffee has been associated with lower levels of exercise.[25] The present study did not have sufficient power to examine the relation between heavy coffee consumption and calcification, because only 84 men and 53 women drank 6 or more cups per day. We performed an additional analysis in which we further split up the upper category of coffee drinking, and found roughly similar results for subjects who drank more than 4 cups and subjects who drank more than 5 cups per day. Therefore, it is conceivable that further increases in coffee are of no extra benefit to women.

One of the strengths of our study is that it is not likely that people changed their coffee consumption pattern during the 7-year follow-up period, because coronary calcification is an asymptomatic outcome and subjects with a clinical CHD at the time of measurement of coronary calcification were excluded. Furthermore, to the best of our knowledge, this is the first population-based study that examined the relation between coffee consumption and coronary calcification. We found different relations between coffee consumption and coronary calcification in men and in women. Other studies of coffee and CHD outcomes do not provide a clear picture on the possible role of gender. In over 11 000 Scottish men and women, aged 40 to 59, a protective association of coffee with coronary heart disease was observed only in men.[26] In a recent study, no association between coffee consumption and CHD was observed in both men and women after a follow-up of 14 years and 20 years, respectively.[5] However, in accordance with our findings, an inverse association was observed between coffee consumption and myocardial infarction after multivariate adjustment in a cohort in 32 650 Swedish women, aged 40 to 74. Relative risk (RR) estimates for low (0.7 to 1 cups/d) and moderate to high (2 to 6+ cups/d) were 0.84 and 0.65, respectively, compared to intakes ≤0.5 cups/d.[8] Also in a Finish cohort of 20 179 men and women, CHD mortality decreased on average by 38% with increasing coffee consumption in women. In men, this relation was U-shaped.[9] Happonen et al also found an independent U-shape dose-response relation between coffee consumption and the incidence of acute myocardial infarction or coronary death in middle-aged men after a follow-up of 5 years.[27]

Smoking is strongly associated both with CHD and coffee consumption. In stratified analysis we were able to remove confounding by smoking from our data. In women, the beneficial effect of coffee on coronary calcification was present both in smokers and nonsmokers. In men, on the contrary, the risk of calcification appeared to be increased in nonsmokers with moderate and high coffee intake. Nonsmoking males comprised mainly former smokers (91%, compared to 43% in women). These subjects may have quitted smoking because of health problems and could be at higher risk of coronary calcification. Therefore, we cannot rule out bias in this stratified analysis. With regard to the findings in present smokers, it is possible that smokers who already died or suffered from CHD are less well represented in our analysis. This may have resulted in "healthy survivor" bias, yielding reduced ORs for high coffee intake. Therefore, subgroup analysis in nonsmokers should be interpreted with caution.

The antioxidant capacity in coffee could be responsible for the beneficial effect in the cardiovascular system. The antioxidant content of coffee per serving is 3.0 mmol/serving.[28] Of the 1113 food samples which were analyzed, only 5 had a higher antioxidant content per serving size. It can be hypothesized that antioxidants in coffee protect against atherosclerosis in the coronary arteries. No consistent associations with coffee were observed in our male participants, for which we have no clear explanation. Possibly, the high prevalence of severe calcification in men (39%, compared to 18% in

women) or the higher degree of calcification in the male reference group (median score: 73 versus 23 in women) could have influenced the risk estimates for coffee. Should the gender-related differences however be true, it could be speculated that an estrogen-related mechanism is involved. Boker et al showed that consumption of phytoestrogens is low in Dutch women, aged 50 to 69 years.[29] Coffee is a main source of phytoestrogens, especially the isoflavones daidzein, genistein, and formononetin that account for 15%, 5%, and 24% of the daily intake, respectively.[29] Phytoestrogens may partly replace estrogen after menopause, thereby protecting against atherosclerotic disease.[30] A previous analysis in the Rotterdam Study showed a more pronounced inverse association of tea drinking with advanced aortic atherosclerosis in women compared to men,[31] and it was hypothesized that this protective effect was attributable to phytoestrogens in tea.[32] On basis of the present analysis, which was adjusted for tea intake, we speculate that estrogenic effects of coffee may have contributed to reduced coronary calcification in women. Coffee, however, also contains caffeine and chlorogenic acid that could elevate plasma homocysteine level, a putative cardiovascular risk factor.[33,34] If true, this adverse effect of coffee may provide another explanation why we found no protective association for coronary calcification in men.

In conclusion, the present study suggests a beneficial effect of coffee drinking against coronary calcification, particularly in women. More research is needed to confirm these findings and to clarify the role of gender and smoking in the relation between coffee consumption and coronary calcification.

Disclosures

None.

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