

Egg Consumption and Coronary Heart Disease and Stroke Mortality: A Prospective Study of US Adults Scrafford C^{1,2}, Barraj L¹, Tran N^{1,2}, Mink P³

¹Exponent Health Sciences Practice, Washington, DC; ²Johns Hopkins Bloomberg School of Public E^XDONENt Health, Baltimore, MD; ³Rollins School of Public Health, Emory University, Atlanta, Ga.

ABSTRACT

The relationship between egg consumption and coronary heart disease (CHD) and stroke mortality was evaluated using the National Health and Nutrition Examination Survey 1988-94 (NHANES III). Egg consumption was obtained from the 30-day food frequency questionnaire. During a mean follow-up of 8.8 years, 366 and 137 deaths due to CHD and stroke, respectively, were identified among 6,833 men and 8,113 women. Multivariate Cox regression models adjusting for health, lifestyle, and dietary factors indicated that "high" egg consumption (>7 times/week vs. <1 time/week) was not associated with significantly increased CHD mortality (hazard ratio in men = 1.13, 95% confidence interval: 0.61, 2.10 and hazard ratio in women = 0.90, 95% confidence interval: 0.27, 3.04). There was a statistically significant inverse association between "high" egg consumption and stroke mortality among men (hazard ratio = 0.28, 95% confidence interval 0.10, 0.76) but the estimate was imprecise because of sparse data. We did not observe a positive association between "high" egg consumption and CHD or stroke mortality in analyses restricted to diabetics. These results corroborate previous studies' findings of no significant positive association between egg consumption and increased risk of mortality from CHD or stroke in the US population.

BACKGROUND

Coronary heart disease (CHD) and stroke are leading causes of death in the United States. Elevated serum low-density lipoprotein (LDL) has been identified as a major risk factor for CHD⁽¹⁾. Data from epidemiological surveys have shown a relationship between dietary cholesterol intake and CHD risk ^(2,3) and metabolic studies have shown that an increase in dietary cholesterol resulted in an increase in plasma total and LDL cholesterol^(4,5). These findings, in part, have lead to guidelines from the American Heart Association (AHA) recommending that healthy adults limit their intake of dietary cholesterol to less than 300 mg per day. Since a large egg contains about 210 mg of cholesterol, or about 71% of the corresponding Daily Recommended Value, the AHA recommends restricting egg consumption unless dietary cholesterol intakes from other sources are limited⁽⁶⁾.

Observational epidemiologic studies that used multiple regression analyses have found no significant positive association between dietary cholesterol and CHD risk⁽⁷⁻¹¹⁾. A cross-sectional study⁽¹²⁾ found that egg consumption was not associated with elevated serum cholesterol concentrations. In addition, four prospective studies showed that after adjustment for other potential risk factors, there was no significant overall association between egg consumption and risk of stroke or CHD⁽¹³⁾ or risk of stroke or cardiovascular disease⁽¹⁴⁻¹⁶⁾. In contrast, several studies have reported significant positive associations between egg intake and CHD mortality among persons with Type 2 diabetes(13, 15, 16)

OBJECTIVE

The purpose of the study is to evaluate the association between egg consumption and CHD and stroke mortality using follow-up mortality data in the NHANES III study population representative of the US adult population.

METHODS

NHANES III is a cross-sectional survey using a stratified, multi-stage probability sample of civilian, non-institutionalized individuals 2 months of age and older residing in the conterminous United States with follow-up for mortality through December 31, 2000 (CHD deaths=168 (women), 198 (men); stroke deaths=74 (women), 63 (men)) (17-19). The dataset for analysis (N = 6,833 men; 8113 women) excluded individuals who were not eligible for follow-up (<17 years of age), had a self-reported history of heart disease, angina or heart attack at baseline, no response to the egg question on the FFQ, or whose reported 24-hour diet total energy intake was <600 or >5,000 KCAL. The FFQ, administered at baseline (1988-1994), asked "How many times over the past month have you consumed eggs including scrambled, fried, omelettes, hard-boiled, and egg salad?" All analyses, including Cox proportional hazards regression, were run using STATA V 10. The results of these analyses are presented here.

Table 2. Egg Consumption and Mortality from Coronary Heart Disease and Stroke in NHANES III Mortality Follow-up

	Egg Consumption							
	<1 Egg EO per ≥1 to <7 Egg EO		≥7 Egg EO per					
	week	per week	week					
Men								
Egg EO per week (range)	0.27 (0-0.7)	1.93 (1.0-6.53)	7.54 (7-49.7)					
CHD								
Deaths from CHD (PY)	53 (17597)	106 (34060)	39 (7877)					
Age and energy adj HR	1.00	1.44 (0.89, 2.33)	1.60 (0.94, 2.72)					
Multi-variate adj* HR	1.00	1.26 (0.79, 1.99)	1.13 (0.61, 2.10)					
Stroke								
Deaths from Stroke (PY)	21 (17597)	32 (34060)	10 (7877)					
Age and energy adj HR	1.00	1.11 (0.52, 2.34)	0.42 (0.17, 1.05)					
Multi-variate adj* HR	1.00	1.01 (0.51, 2.02)	0.28 (0.10, 0.76)					
Women								
Egg EO per week (range)	0.24 (0-0.7)	1.79 (1.0-6.3)	7.41 (7-35.5)					
CHD								
Deaths from CHD (PY)	72 (28626)	74 (35871)	22 (5770)					
Age and energy adj HR	1.00	1.06 (0.71, 1.57)	0.96 (0.38, 2.46)					
Multi-variate adj* HR	1.00	11.0.66, 1.86)	0.91 (0.27, 3.04)					
Stroke								
Deaths from Stroke (PY)	26 (28626)	39 (35871)	9 (5770)					
Age and energy adj HR	1.00	1.05 (0.55, 2.00)	1.23 (0.38, 3.91)					
Multi-variate adj* HR	1.00	0.93 (0.46, 1.90)	1.02 (0.25, 4.20)					
EO = eating occasion; PY = person years; HR = Hazard ratio (95% CI)								

to = eating occasion, FT = person years, HH = Hazard Tatlo (95% CI)							
Adjusted for age, energy, marital status, educational status, race/ethnicity, smoking status, BMI, WHR							
diabetes, hypertension, and dietary variables.							

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Table 3. Egg Consumption and Mortality from Coronary Heart Disease and Stroke Among People with Diabetes

	Egg Consumption					
	<1 Egg EO per	≥1 to <7 Egg EO per	≥7 Egg EO per			
	week	week	week			
Egg EO per week (range)	0.22 (0-0.7)	1.87 (1.0-6.07)	7.21 (7-35.5)			
СНD						
Deaths from CHD (PY)	16 (1882)	34 (3455)	16 (1200)			
Age and energy adjusted HR	1.00	0.63 (0.24, 1.64)	0.97 (0.40, 2.39)			
Stroke						
Deaths from Stroke (PY)	7 (1882)	12 (3455)	5 (1200)			
Age and energy adjusted HR	1.00	1.79 (0.93-6.3)	0.32 (0.07, 1.42)			
EO = eating occasion; PY = person years; HR = Hazard ratio (95% CI)						

Adjusted for age, energy, marital status, educational status, race/ethnicity, smoking status, BMI, WHR, diabetes, hypertension, and dietary variables

RESULTS

•The mean number of eating occasions (EO) of eggs in the study population was 0.25 EO/day (1.7 EO/week) and 0.19 EO/day (1.3 EO/week) among men and women, respectively. •After adjustment for age and energy, there was no evidence of a statistically significant increased risk of death from CHD or stroke (Table 2) in either men or women •There was no evidence of a trend of increased rate of CHD mortality with increasing egg consumption based on the lack of a monotonic pattern.

•When we restricted the analysis to men and women with self-reported Type 2 diabetes, we did not observe a significant positive association between egg consumption and CHD or stroke mortality (Table 3). This analysis is limited by the small number of observed cases.

CONCLUSION

In conclusion, we observed a lack of association between regular egg consumption and increased risk of CHD or stroke among a sample representative of the US adult population. These results are consistent with previous findings and the recommendation to limit egg consumption as a way to prevent cardiovascular disease may be misguided.

Table 1. Baseline Characteristics by Category of Egg Consumption for 14,946 Cardiovascular Disease-Free Men and Women, NHANES III, 1988-1994

			Men	-		Women	
		<1 Egg EO per week	≥1 to <7 Egg EO per week	≥7 Egg EO per week	<1 Egg EO per week	≥1 to <7 Egg EO per week	≥7 Egg EO per week
Continuous Variat	oles (Mean (SE))			1		
Age at death or fo	low-up (years)	40.8 (0.6)	41 (0.5)	43.4 (1.2)	43.2 (0.4)	42.3 (0.5)	41.3 (1.4)
Energy intake (kca	l) (DMI)	2504 (30)	2629 (26)	2574 (67)	1744 (16)	1876 (19)	2098 (88)
Body mass index		20.2 (0.1)	20.4 (0.1)	25.5 (0.2)	25.9 (0.2)	20.4 (0.2)	25.7 (0.4)
Waist to hin ratio (WHR)	0.943 (0.003)	(0.002)	0 949 (0 005)	0.858 (0.003)	0.861 (0.003)	0.879 (0.005)
Total fat (g/dav)	,	96.6 (1.3)	99.7 (0.9)	102.4 (1.7)	68.8 (0.6)	70.6 (0.7)	67.4 (1.7)
Total SAFA (g/day)	1	32.6 (0.5)	33.6 (0.4)	34 (0.8)	23 (0.3)	23.8 (0.3)	22.1 (0.9)
Total MUFA (g/day)	36.7 (0.6)	37.9 (0.4)	39.5 (0.8)	25.5 (0.2)	26.2 (0.3)	24.8 (0.7)
Total PUFA (g/day)		20 (0.3)	20.5 (0.4)	20.7 (0.8)	15.2 (0.2)	15.3 (0.2)	14.9 (0.6)
Alcohol intake (g/c	lay)	12.1 (0.9)	14.2 (0.9)	13.8 (2.1)	5.9 (0.7)	5.9 (0.8)	3.5 (1.1)
Dietary fiber (g/day	y)	19.4 (0.4)	18.5 (0.3)	17.8 (0.4)	14.8 (0.2)	14.2 (0.2)	13.1 (0.4)
Dietary Cholestero	ol (mg/day)	288.9 (6.7)	357.7 (7)	489.8 (19.4)	203 (3.3)	242.2 (4.7)	342 (22.5)
Dietary Carotenoic	ls intake						
(RE/day)		585.8 (34.4)	526.3 (25.2)	600.6 (58.4)	479.7 (22.7)	482.3 (19.8)	621.7 (99.2)
vitamin E (i0/day)		11.2 (0.3)	10.6 (0.2)	10.6 (0.5)	0.3 (0.2)	0.4 (0.2)	7.9 (0.3)
Dietary Vitamin C	(mg/day)	120.2 (4.5)	108.6 (3.2)	108.7 (6.6)	98.4 (2.4)	95.8 (2.6)	120.1 (10.9)
Dietary Folate Inta	ke (ug/day)	329.5 (7.6)	320.9 (4.9)	315.4 (11.9)	253.5 (5.5)	241.5 (3.9)	246.8 (12.2)
Fruit (servings/day	()	1.7 (0.1)	1.5 (0.1)	1.2 (0.1)	1.6 (0.1)	1.4 (0.1)	1.4 (0.2)
Vegetables (servin	gs/day)	3.5 (0.1)	3.5 (0.1)	3.5 (0.2)	2.9 (0.1)	3 (0.1)	3.3 (0.3)
Whole grains (servings/day)		7.9 (0.2)	8 (0.1)	8 (0.4)	5.8 (0.1)	5.9 (0.1)	6.4 (0.3)
Categorical Variab	les (%)	-					
Married	No	35.4	30.0	43.4	41.5	39.0	37.1
	Yes	64.6	70.0	56.6	58.5	61.0	62.9
Type 2 Diabetes	No	97.0	96.2	92.8	96.6	96.3	92.3
	Yes	3.0	3.8	7.2	3.4	3.7	7.7
Hypertension	No	78.0	81.5	84.5	78.0	77.5	77.8
1	Yes	22.0	18.5	15.5	22.0	22.5	22.2
Education	<12 years	22.8	26.0	45.5	22.2	23.9	40.9
Luccuton	12 years	27.9	32.3	29.7	35.8	38.2	37.9
	12 years	40.0	41.7	23.7	41.0	00.2	01.0
Smoker Status	>12 years	49.3	41.7	24.9	41.9	37.9	21.2
Smoker Status	ourrent/past	55.7	01.4	00.7	43.0	40.2	41.2
Dense (Etherladter	Never	44.3	38.6	31.3	56.4	54.8	58.8
nace/Ethnicity	write	81.0	/5.4	55.5	80.0	74.9	44.1
	Black	8.5	10.3	19.6	10.9	11.1	24.8
	Mexican-		6.0	10.2	2.0	5.0	14.0
	American	3.2	0.8	12.3	3.0	5.6	14.6
Otradas Mantal'i	Other	7.3	7.4	12.6	6.1	8.5	16.4
Stroke Mortality		21	32	10	26	39	9
CHD Mortality		53	106	39	72	/4	22

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