Milk intake and risk of mortality and fractures in women and men: cohort studies

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Abstract

Objective To examine whether high milk consumption is associated with mortality and fractures in women and men.

Design Cohort studies.

Setting Three counties in central Sweden.

Participants Two large Swedish cohorts, one with 61 433 women (39-74 years at baseline 1987-90) and one with 45 339 men (45-79 years at baseline 1997), were administered food frequency questionnaires. The women responded to a second food frequency questionnaire in 1997.

Main outcome measure Multivariable survival models were applied to determine the association between milk consumption and time to mortality or fracture.

Results During a mean follow-up of 20.1 years, 15 541 women died and 17 252 had a fracture, of whom 4259 had a hip fracture. In the male cohort with a mean follow-up of 11.2 years, 10 112 men died and 5066 had a fracture, with 1166 hip fracture cases. In women the adjusted mortality hazard ratio for three or more glasses of milk a day compared with less than one glass a day was 1.93 (95% confidence interval 1.80 to 2.06). For every glass of milk, the adjusted hazard ratio of all cause mortality was 1.15 (1.13 to 1.17) in women and 1.03 (1.01 to 1.04) in men. For every glass of milk in women no reduction was observed in fracture risk with higher milk consumption for any fracture (1.02, 1.00 to 1.04) or for hip fracture (1.09, 1.05 to 1.13). The corresponding adjusted hazard ratios in men were 1.01 (0.99 to 1.03) and 1.03 (0.99 to 1.07). In subsamples of two additional cohorts, one in males and one in females, a positive association was seen between milk intake and both urine 8-iso-PGF2α (a biomarker of oxidative stress) and serum interleukin 6 (a main inflammatory biomarker).

Conclusions High milk intake was associated with higher mortality in one cohort of women and in another cohort of men, and with higher fracture incidence in women. Given the observational study designs with the inherent possibility of residual confounding and reverse causation phenomena, a cautious interpretation of the results is recommended.

Table 2

Milk consumption and time to death and fracture in Swedish Mammography Cohort* and Cohort of Swedish Men

Variables	Categories of daily milk intake				Continuous (per 200 g)
	<1 glass (<200 g/d)	1–2 glasses (200–399 g/d)	2–3 glasses (400–599 g/d)	≥3 glasses (≥600 g/d)	
Swedish Mammography Cohort					
Total mortality:					
No of deaths	5422	5830	3150	1139	15541
Person years of follow-up	476 485	444 724	229648	80961	1 231 818
Rate/1000 person years†	10.7	12.6	15.4	17.7	12.6
Age adjusted HR (95% CI)	1.00 (reference)	1.30 (1.25 to 1.35)	1.83 (1.75 to 1.91)	2.20 (2.06 to 2.35)	1.18 (1.16 to 1.20)
Multivariable adjusted HR (95% CI)‡	1.00 (reference)	1.21 (1.16 to 1.25)	1.60 (1.53 to 1.68)	1.93 (1.80 to 2.06)	1.15 (1.13 to 1.17)
Cardiovascular mortality:					
No of deaths	1904	1989	1030	355	5278
Person years of follow-up	476 485	444 724	229 648	80 961	1 231 818
Rate/1000 person years†	3.6	4.3	5.3	6.2	4.3
Age adjusted HR (95% CI)	1.00 (reference)	1.26 (1.18 to 1.34)	1.85 (1.71 to 1.99)	2.19 (1.96 to 2.46)	1.20 (1.16 to 1.23)
Multivariable adjusted HR (95% CI)‡	1.00 (reference)	1.16 (1.09 to 1.24)	1.59 (1.47 to 1.73)	1.90 (1.69 to 2.14)	1.15 (1.12 to 1.19)
Cancer mortality:					
No of deaths	1412	1196	488	187	3283
Person years of follow-up	476 485	444 724	229 648	80 961	1 231 818
Rate/1000 person years†	2.8	2.6	2.4	2.8	2.7
Age adjusted HR (95% CI)	1.00 (reference)	1.11 (1.02 to 1.19)	1.24 (1.12 to 1.37)	1.55 (1.33 to 1.80)	1.09 (1.05 to 1.13)
Multivariable adjusted HR (95% CI)‡	1.00 (reference)	1.07 (0.99 to 1.15)	1.16 (1.04 to 1.29)	1.44 (1.23 to 1.69)	1.07 (1.02 to 1.11)
Any fracture:					
No of fractures	7080	6317	2912	943	17252
Person years of follow-up	424 857	402 138	210 610	75 231	1 112 837
Rate/1000 person years†	16	15.4	15	15.1	15.5
Age adjusted HR (95% CI)	1.00 (reference)	1.09 (1.04 to 1.11)	1.17 (1.12 to 1.22)	1.16 (1.08 to 1.24)	1.02 (1.00 to 1.03)
Multivariable adjusted HR (95% CI)‡	1.00 (reference)	1.07 (1.04 to 1.11)	1.16 (1.11 to 1.21)	1.16 (1.08 to 1.25)	1.02 (1.00 to 1.04)
Hip fracture:					
No of fractures	1584	1620	808	247	4259
Person years of follow-up	468 603	436 885	225 969	79 838	1 211 295
Rate/1000 person years†	3.1	3.6	4.1	4.2	3.5
Age adjusted HR (95% CI)	1.00 (reference)	1.24 (1.16 to 1.33)	1.69 (1.55 to 1.85)	1.76 (1.54 to 2.02)	1.11 (1.08 to 1.15)
Multivariable adjusted HR (95% CI)‡	1.00 (reference)	1.19 (1.11 to 1.28)	1.55 (1.41 to 1.69)	1.60 (1.39 to 1.84)	1.09 (1.05 to 1.13)
Cohort of Swedish Men					
Total mortality:					
No of deaths	3468	2501	2347	1796	10112
Person years of follow-up	221 381	127 248	103 049	82 415	534094
Rate/1000 person years†	18.2	18.3	19.6	20.7	18.9
Age adjusted HR (95% CI)	1.00 (reference)	1.00 (0.95 to 1.05)	1.07 (1.02 to 1.13)	1.13 (1.07 to 1.19)	1.03 (1.02 to 1.05)
Multivariable adjusted HR (95% CI)‡	1.00 (reference)	0.99 (0.94 to 1.05)	1.05 (1.00 to 1.11)	1.10 (1.03 to 1.17)	1.03 (1.01 to 1.04)
Cardiovascular mortality:					
No of deaths	1468	1161	1098	841	4568
Person years of follow-up	221 381	127 248	103049	82 415	534 094
Rate/1000 person years†	7.9	8.4	9	9.6	8.6
Age adjusted HR (95% CI)	1.00 (reference)	1.06 (0.98 to 1.15)	1.14 (1.05 to 1.23)	1.21 (1.11 to 1.32)	1.05 (1.03 to 1.07)
Multivariable adjusted HR (95% CI)‡	1.00 (reference)	1.04 (0.96 to 1.12)	1.10 (1.01 to 1.19)	1.16 (1.06 to 1.27)	1.05 (1.03 to 1.07)
Cancer mortality:					
No of deaths	1077	704	616	484	2881
Person years of follow-up	221 381	127 248	103 049	82 415	534 094
Rate/1000 person years†	5.5	5.2	5.4	5.6	5.4
Age adjusted HR (95% CI)	1.00 (reference)	0.95 (0.87 to 1.05)	0.97 (0.88 to 1.07)	1.03 (0.92 to 1.14)	1.00 (0.98 to 1.03)
Multivariable adjusted HR (95% CI)‡	1.00 (reference)	0.97 (0.88 to 1.07)	0.97 (0.87 to 1.07)	1.01 (0.90 to 1.13)	0.99 (0.97 to 1.02)
Any fracture:					
No of fractures	2095	1326	1095	863	5379
Person years of follow-up	211 554	121 162	98 290	78 355	509 361
Rate/1000 person years†	10.5	10.7	10.5	10.8	10.6
Age adjusted HR (95% CI)	1.00 (reference)	1.02 (0.95 to 1.10)	1.01 (0.94 to 1.09)	1.03 (0.96 to 1.12)	1.01 (1.00 to 1.03)
Multivariable adjusted HR (95% CI)‡	1.00 (reference)	1.02 (0.96 to 1.10)	1.01 (0.93 to 1.08)	1.03 (0.94 to 1.11)	1.01 (0.99 to 1.03)
Hip fracture:					
No of fractures	439	309	318	200	1266
Person years of follow-up	219 925	126 241	102 126	81 755	530 047
Rate/1000 person years†	2.4	2.3	2.7	2.3	2.4
Age adjusted HR (95% CI)	1.00 (reference)	0.95 (0.82 to 1.10)	1.12 (0.96 to 1.29)	0.97 (0.82 to 1.15)	1.02 (0.98 to 1.06)
Multivariable adjusted HR (95% CI)‡	1.00 (reference)	0.95 (0.82 to 1.11)	1.13 (0.97 to 1.31)	1.01 (0.85 to 1.20)	1.03 (0.99 to 1.07)

HR=hazard ratio.

*Had access to repeat exposure information; exposures and covariates were treated as cumulative averages.