Inverse association between milk intake frequency and all-cause mortality in the JACC study

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Background

- Milk contains a number of bioactive nutrients including saturated fat, protein and calcium as well as vitamins.
- The effects of increased intake of milk on all-cause mortality are uncertain.
- Previous studies, however, have suggested that increased milk intake may be protective for stroke, and may had a reduced risk for ischaemic heart disease event.

Objective

To examine the association of milk intake frequency with all-cause mortality in a large community-based cohort of Japanese men and women incorporating potential confounding variables.

Method

- Subjects and exclusion

N = 110,586 (46,396 men and 64,190 women) aged 40-79 in 1988-90

- Missing information on the milk intake frequency excluded (N = 20,386)
- Missing value of Body mass index (BMI), exercise, smoking status, drinking status, self-reported sleeping duration, education years, were coded as "unknown" group. And were treated as an additional category in the model

N = 90,200 (37,864 men and 52,336 women)

- Methods: statistical analysis

Cox proportional hazard model adjusted for 5-year age groups and potential confounding variables:

- Drinking and smoking habit (current, past, never, unknown)
- BMI (kg/m^2)
- Sleep duration (<6.5 h; 6.5-8.5 h; ≥8.5 h, unknown)
- Exercise more than 1 hour / week (yes, no, unknown)
- Disease histories of hypertension, diabetes, cancer, myocardial infarction or stroke. (yes, no, unknown)

Linear trend in mortality risk was assessed by treating the response of milk consumption as an ordinal variable:

- Don't drink = 0
- 1-2 times per month = 0.05
- 1-2 times per week = 0.21
- 3-4 times per week = 0.5
- Almost everyday = 1

Additional analyses :

- Stratifying subjects by baseline age (younger: 40-59 years and older: 60-79 years)
- Cause-specific mortality (Cancer ICD10: C00-D48, Circulatory diseases ICD10: I00-I99, others)
- All statistical analyses were performed using the epicalc: Epidemiological calculator, R package version 2.15.1

Results:

Table 1. Means (standard deviations) or percentages of study participants at baseline according to milk consumption categories, 1988-1990, JACC Study

		Don't drink	1-2 times/month	1-2 times/week	3-4 times/week	Almost everyday	Missing
Men							
Number of individuals		8,075	3,370	5,645	5,281	15,493	8,533
Age	*years*	57.1 (10.0)	55.6 (10.3)	55.8 (10.2)	55.9 (10.1)	58.7 (10.1)	59.5 (10.1)
Height	*cm*	162.5 (6.8)	162.9 (6.7)	163.2 (6.7)	163.2 (6.6)	163.0 (6.4)	162.3 (6.8)
Body mass index	*kg/m²*	22.6 (3.5)	22.8 (2.8)	22.8 (2.8)	22.9 (5.6)	22.6 (2.8)	22.5 (2.8)
Age-adjusted mortality rate	*/(1000 person-years)*	17.9	15.7	16.0	16.0	15.8	17.6
Current smokers	*%*	57.7	56.6	54.6	50.2	44.3	50.1
Current drinkers	*%*	72.4	75.6	73.9	75.3	70.0	68.5
Walking ≥ 1h / day	*%*	36.9	42.1	38.2	36.1	38.8	34.6
Exercise ≥ 1h / week	*%*	19.1	26.6	25.0	26.0	29.8	21.7
Sleep duration							
<6.5 hours	*%*	16.5	16.0	16.1	15.9	15.6	14.4
6.5-8.5 hours	*%*	66.1	68.1	68.1	67.7	68.6	61.6
≥8.5 hours	*%*	13.8	10.9	11.1	11.0	11.1	15.7
unknown	*%*	3.6	5.0	4.7	5.4	4.7	8.3
Attended school until							
18 years old	*%*	60.0	66.9	59.7	54.7	61.0	58.5
older than 18	*%*	10.0	12.1	13.0	11.4	16.1	9.8
unknown	*%*	30.0	21.0	27.3	33.9	22.9	31.7
Women							
Number of individuals		9,816	3,467	7,169	7,693	24,191	11,854
Age	*years*	58.2 (10.2)	56.7 (10.2)	55.8 (10.2)	55.9 (9.9)	58.2 (9.9)	59.8 (10.8)
Height	*cm*	150.5 (6.1)	150.7 (6.3)	151.2 (5.9)	151.4 (5.7)	151.3 (5.3)	150.5 (6.2)
Body mass index	*kg/m²*	23.0 (3.4)	23.1 (3.8)	23.1 (4.5)	23.1 (3.1)	22.8 (3.3)	22.9 (4.0)
Age-adjusted mortality rate	*/(1000 person-years)*	7.9	7.6	7.5	7.2	7.1	7.9
Current smokers	*%*	7.7	6.0	5.4	4.3	3.5	4.9
Current drinkers	*%*	19.8	22.1	24.0	25.1	22.7	19.7
Walking ≥ 1h / day	*%*	38.3	42.5	40.3	35.6	40.3	35.6
Exercise ≥ 1h / week	*%*	13.5	16.9	18.6	18.7	22.6	17.0
Sleep duration							
<6.5 hours	*%*	24.9	26.3	23.9	23.3	25.3	22.7
6.5-8.5 hours	*%*	61.0	60.3	63.8	63.4	63.0	59.7
≥8.5 hours	*%*	9.3	7.8	6.5	6.1	6.1	8.6
unknown	*%*	4.8	5.6	5.8	7.2	5.6	9.0
Attended school until							
18 years old	*%*	65.6	72.9	66.2	60.8	69.7	64.4
older than 18	*%*	4.7	6.7	7.1	6.5	9.3	6.3
unknown	*%*	29.7	20.4	26.7	32.7	21.0	29.3

Results (continued)

- Median follow-up period = 18.8 year (IQR: 10.9-20.9 year);
- 33.4% men and 37.7% women drank milk almost everyday;
- Total number of death cases = 21,485 (12,161 men and 9,324 women)

  34.4% were caused by cancer (36.6%, men; 29.9%, women);

  29.9% were caused by circulatory diseases (27.8%, men; 33.7%, women)

Figure 1. Multivariable-adjusted hazard HRs and 95% CIs for all-cause mortality according to milk intake frequency categories in MEN

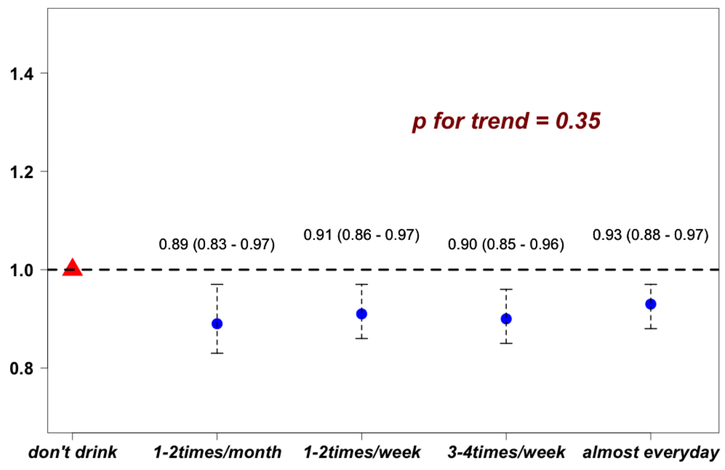


Figure 2. Multivariable-adjusted hazard HRs and 95% CIs for all-cause mortality according to milk intake frequency categories in WOMEN

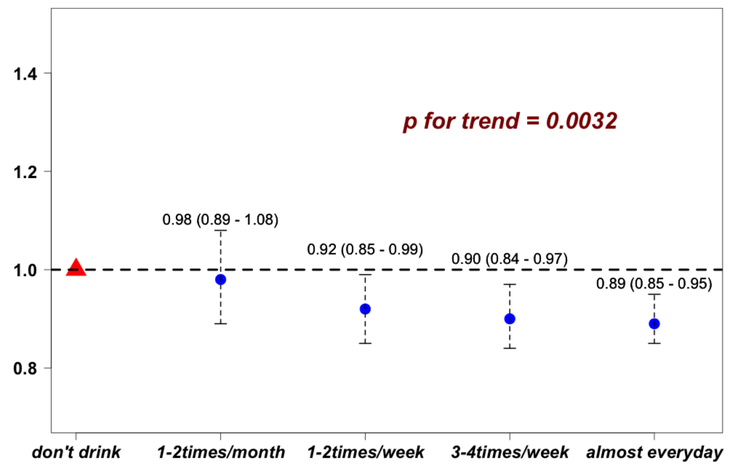


Figure 3. Multivariable-adjusted hazard HRs and 95% CIs for all-cause mortality according to milk intake frequency categories in OLDER MEN

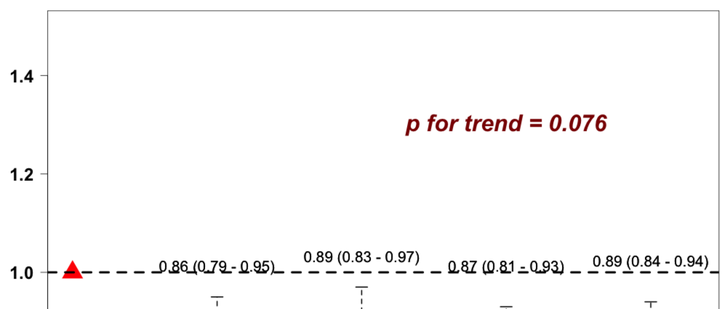


Figure 4. Multivariable-adjusted hazard HRs and 95% CIs for all-cause mortality according to milk intake frequency categories in OLDER WOMEN

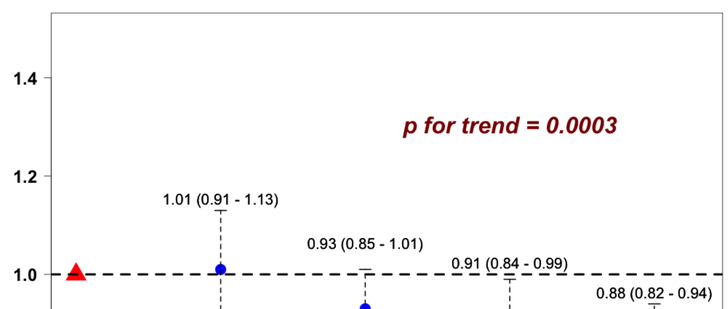


Figure 5. Multivariable-adjusted hazard HRs and 95% CIs for cancer mortality according to milk intake frequency categories in MEN

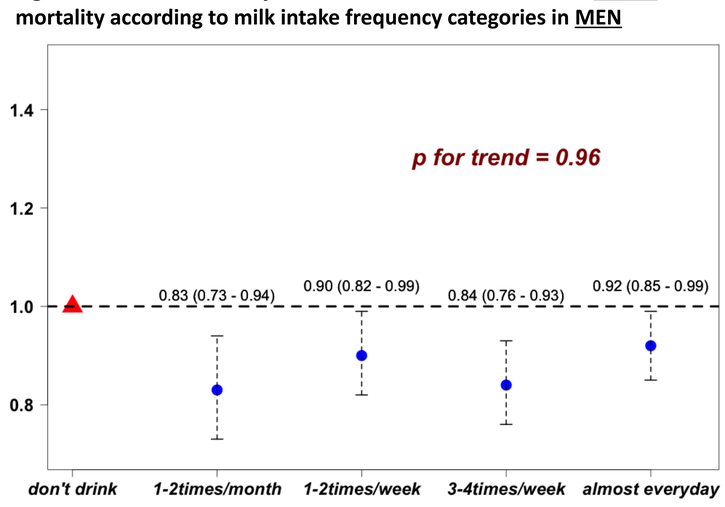
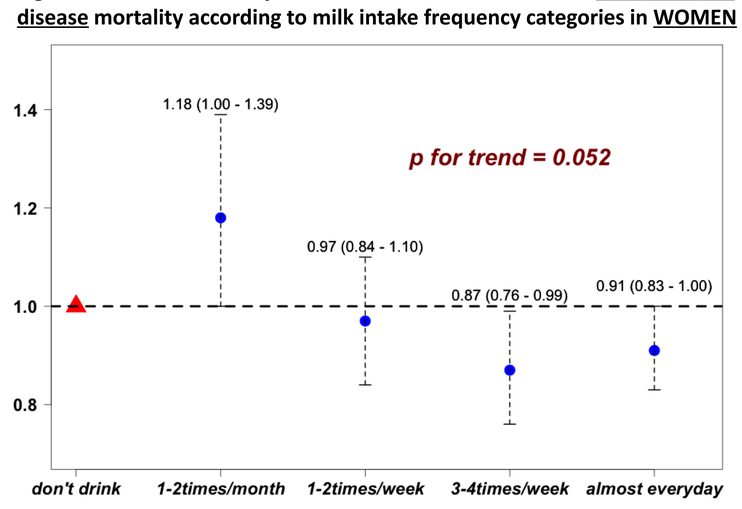


Figure 6. Multivariable-adjusted hazard HRs and 95% CIs for cardiovascular disease mortality according to milk intake frequency categories in WOMEN



Multivariable-adjusted HR: adjusted for age categories, smoking status, drinking behavior, exercise habit, sleeping duration, body mass index, history of hypertension, diabetes, cancer, myocardial infarction, and stroke.

- No significant results were found in younger participants (40-59 years);
- Multivariate-adjusted all-cause mortality HRs of each milk intake frequency categories were significantly lower than 1 in both men and women compared to those who never drank milk;
- Increased frequency of drinking milk was negatively associated with mortality caused by cardiovascular disease.

Discussion

- One previous report from JACC study indicated that higher intake of diary calcium was associated with significant lower risk of stroke mortality
- Biochemical and/or physiological effects of milk itself (milk minerals, calcium, potassium, dairy phosphorus, etc.) and other healthy lifestyles (eating habit, etc.) associated with milk drinking behavior might explain the inverse association.
- Subjects who did not drink milk might have had some health conditions that prevented them from drinking milk.

Conclusion

- Milk intake was associated with lower risk of all-cause mortality in both men and women. These observed associations were probably explained by lower cancer mortality in men and lower circulatory diseases mortality in women associated with milk intake.
- Drinking milk was inversely associated with mortality in a Japanese cohort with its baseline around 1990.