Lifetime Milk Consumption and Bone Mineral Density in Older Women

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ABSTRACT

This study examined the relation between lifetime milk consumption and both axial and appendicular bone mineral density in 581 postmenopausal White women. Positive significant, graded associations between milk consumption in adulthood and bone mineral density at the spine, total hip, trochanter, intertrochanter, and midradius, but not the ultradistal wrist or femoral neck, were observed. Adolescent milk consumption showed similar, statistically significant associations (spine and midradius). Associations were independent of age, body mass index, years postmenopausal, thiazide, estrogen and alcohol use, smoking, and exercise. Regular milk consumption in youth and adulthood is associated with better bone mineral density at cortical and trabecular sites in elderly women. (*Am J Public Health.* 1994;84:1319–1322)

Introduction

Osteoporotic low bone mineral density often leads to fractures, costly hospitalization, and prolonged use of health services.[1] Milk accounts for about half of all dietary calcium intake in North America (B. Nowlin, California Dairy Council, telephone conversation, June 1993),[2] and the importance of calcium in milk for attaining peak bone mass[3,4] and preventing osteoporosis[5–7] may relate to the quantity consumed during specific life periods.[5,8–10] In this paper, we report the association of lifetime milk consumption with bone mineral density in a community-based cohort of older women.

Methods

Study Population and Data Collection

Between 1972 and 1974, 82% of adult residents of Rancho Bernardo, Calif, enrolled in a heart disease survey.[11] From 1988 to 1991, 84% (n = 624) of surviving, local, 60- to 79-year-old women from this cohort participated in a study of bone mineral density. All were ambulatory and provided written informed consent. The 624 women were administered a standardized interview to assess their medical and life-style history, including smoking history, estrogen and thiazide use, alcohol consumption, and exercise. A standardized food-frequency questionnaire[12] was used to assess the subjects' current dietary calcium intake and their calcium supplementation history. Participants also quantified their daily milk consumption during adolescence (12 to 19 years of age), midlife (20 to 50 years of age), and older adulthood (after 50 years of age) as (1) "rarely or never" (classified as none), (2) "about every week, but not every day" (low), (3) "1 to 2 glasses per day, about every day" (medium), or (4) "3 or more glasses per day, about every meal" (high). Childhood milk intake was not queried because of expected poor recall.

Height and weight were measured with women in light clothing without shoes; body mass index (weight divided by square of height [kg/m^2]) was calculated to estimate obesity. Bone mineral density of the lumbar spine and hip was measured by dual-energy x-ray absorptiometry. Bone mineral density of the ultradistal wrist and midradius of the nondominant arm was measured by single-photon absorptiometry.[13]

This analysis includes all 581 women who provided data on milk consumption history and had bone mineral density measurements.

Statistical Analysis

SAS was used for all analyses.[14,15] The Mantel-Haenszel test was used to identify linear trends in categorical variables by milk consumption history. Analysis of covariance was used in trend analyses of continuously distributed covariates and in site-specific calculations of mean bone mineral density levels by milk consumption category; adjustments were made for the confounding effects of age, body mass index, years postmenopausal, smoking history, current use of thiazides and estrogen replacement therapy, current exercise, and alcohol consumption. Very few women reported high milk consumption during midlife (n = 27) or older adulthood (n = 17); therefore, the medium and high categories were pooled for these age periods. Separate analyses were conducted in which calcium supplementation was stratified. All statistical tests were two-tailed, with statistical significance defined as $P < .05$.

Results

The average age of participants was 70.6 years, and all were White. The women had been postmenopausal for an average of 24 years. At the time of

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TABLE 1—Health Behaviors and Reported Milk Consumption at Three Age Periods: Rancho Bernardo, Calif, Women (n = 581), 1988 to 1991

	None	Low	Medium	High	*P* for Trend
Adolescence					
Consumption, %	19	17	42	23	. . .
Mean age, y	72	72	71	68	.0001
Mean BMI, kg/m^2	25	24	25	25	.15
Mean no. of years postmenopausal	27	25	24	22	.0001
Mean total calcium intake, mg	818	924	1068	1134	.0001
Taking estrogen, %	36	45	42	43	.40
Ever smoked, %	56	68	55	47	.05
Taking thiazides, %	24	25	25	22	.79
Exercising 3+ times per week, %	70	70	74	67	.83
Drinking alcohol 3+ days per week, %	44	49	42	41	.41
Taking calcium supplements, %	46	45	54	47	.54
Ever used calcium supplments, %	67	72	74	79	.06
Midlife					
Consumption, %	28	34	33	5	. . .
Mean age, y	72	71	70	66	.0001
Mean BMI, kg/m^2	24	25	25	25	.39
Mean no. of years postmenopausal	26	23	24	21	.003
Mean total calcium intake, mg	790	960	1206	1327	.0001
Taking estrogen, %	42	39	42	50	.64
Ever smoked, %	59	59	50	46	.03
Taking thiazides, %	27	28	20	14	.05
Exercising 3+ times per week, %	67	68	77	79	.03
Drinking alcohol 3+ days per week, %	47	44	39	39	.15
Taking calcium supplements, %	49	52	48	41	.52
Ever used calcium supplements, %	68	79	72	74	.49
Older adulthood					
Consumption, %	41	27	29	3	. . .
Mean age, y	71	71	71	67	.01
Mean BMI, kg/m^2	25	25	25	26	.40
Mean no. of years postmenopausal	25	24	23	22	.21
Mean total calcium intake, mg	760	1006	1310	1614	.0001
Taking estrogen, %	44	38	43	27	.48
Ever smoked, %	61	51	53	53	.08
Taking thiazides, %	26	29	19	7	.06
Exercising 3+ times per week, %	67	72	74	87	.05
Drinking alcohol 3+ days per week, %	48	43	39	27	.03
Taking calcium supplements, %	49	47	54	40	.57
Ever used calcium supplements, %	71	74	77	67	.27

Note. BMI = body mass index.

evaluation, 42% were using estrogen replacement therapy, 24% were using thiazides, 44% had never smoked, 71% exercised three or more times per week, and 43% drank alcohol more than three times per week. The mean total calcium intake was 1013 mg/day; 50% were currently taking calcium supplements.

As shown in Table 1, milk consumption declined with age. Only 19% of respondents reported that they drank no milk during adolescence, whereas 28% and 41%, respectively, indicated no milk consumption during midlife and older adulthood. More than 92% of women who drank little or no milk in adolescence drank little or no milk later in life. Milk intake in youth was inversely associated with smoking and positively associated with calcium supplements; no other variables were associated with teenage milk consumption. After adolescence, higher milk intake was associated with less smoking, less thiazide use, and more exercise, and after 49 years of age, higher intake was associated with less frequent alcohol consumption. Current use of estrogen or calcium supplements was not significantly associated with milk intake.

Figure 1 shows that higher milk consumption in adulthood was independently and significantly associated with higher bone mineral density levels at the midradius, spine, total hip, intertrochanter, and trochanter. Higher teenage milk intake was associated with significantly higher bone mineral density at the spine and midradius. Milk intake was not associated with bone mineral density of the ultradistal wrist. Analyses stratified by calcium supplementation revealed similar patterns (data not shown).

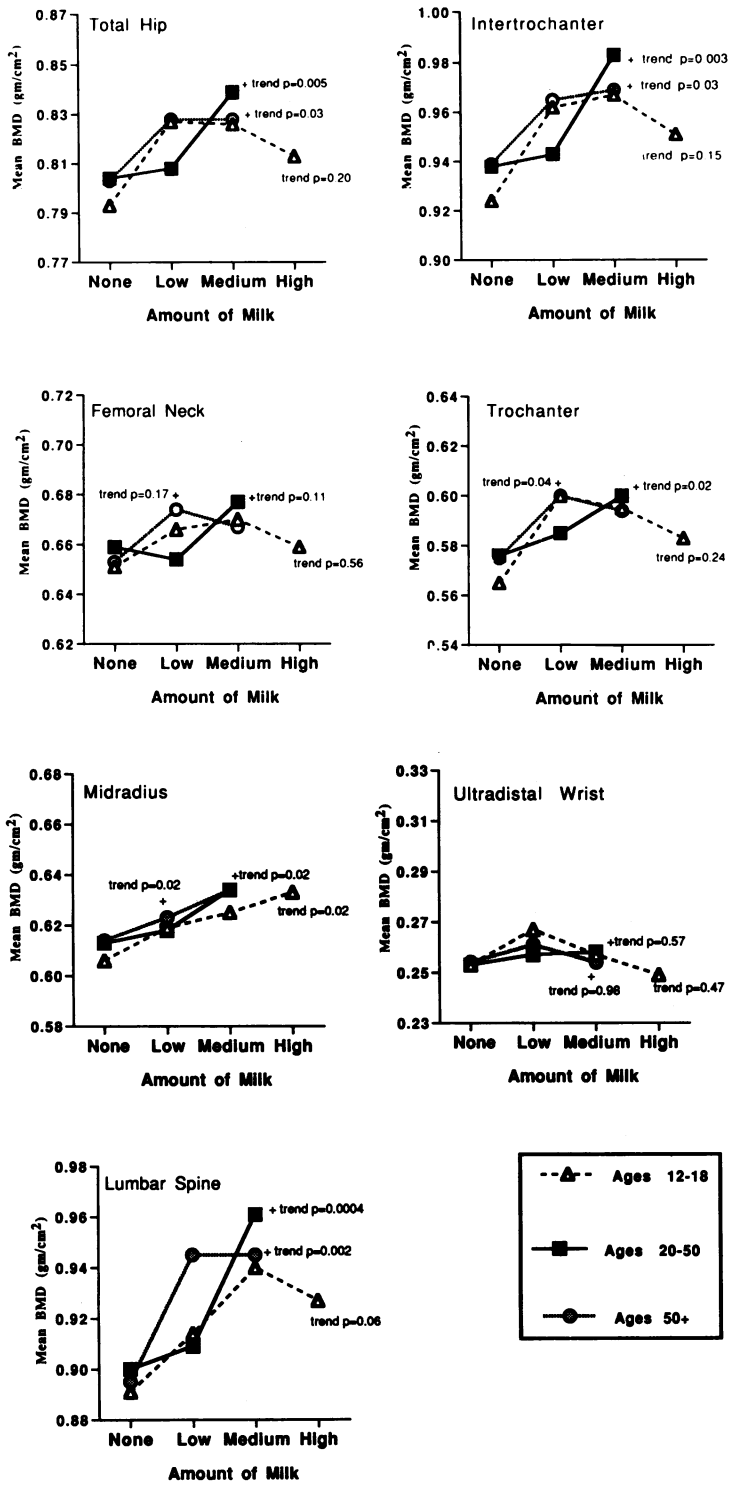
Discussion

Graded, significant associations between milk intake during three age periods and bone mineral density of the axial and appendicular skeleton were observed. These associations, independent of other major bone mineral density determinants, were strongest for milk intake during midlife (20 to 50 years of age).

The observed relation between bone mineral density and postadolescent milk consumption is consistent with evidence that a calcium-rich diet during adulthood contributes to peak bone mass[3,4,16] and/or helps minimize bone loss.[17–19] The weaker association of adolescent milk consumption with bone mineral density may reflect less variation in intake (adults have greater independence in beverage choices), inaccuracies of longer recall, or the lower per capita milk consumption during the Great Depression, which coincided with many participants' adolescent years. Alternatively, it may reflect the fact that most members of this cohort were children or teenagers when vitamin D, which mediates the absorption of calcium,[5] was first added to the US milk supply.[20]

The somewhat weaker trends for the oldest adults may reflect the downward shift in milk consumption with age. High intake after 50 years of age consequent to awareness of personal osteoporosis status did not appear to be a factor, since the relation between milk consumption and bone mineral density was not altered when the 65 women with physician-diagnosed osteoporosis or nontraumatic fractures were excluded from analysis (data not shown). Some older women may have decreased their milk consumption for health reasons.

Although self-reported milk consumption over a period of 50 years or more cannot be validated, it is unlikely that misclassification accounts for the observed association; measurement error in observational studies tends to reduce or obscure a true association.[21] Reported intake was remarkably stable over time for those who reported that they did not drink milk, with a downshift in high



Note. Means were adjusted for age, body mass index, years postmenopausal, smoking history, thiazide use, current use of estrogen replacement therapy, exercise, and alcohol consumption. Analysis of covariance was used in these calculations. BMD was measured in gm/cm². The medium and high milk consumption categories were pooled because of the small sample size of the high category for the two oldest age groups.

FIGURE 1—Multiply adjusted mean bone mineral density (BMD), by milk consumption and age group: Rancho Bernardo, Calif, women (n = 581), 1988 to 1991.

consumption with age. The proportion reporting high milk intake closely resembles that reported in similar age categories by others.[10]

Milk consumption was not associated with bone mineral density of the ultradistal wrist. Although it is possible that bone mineral density at this site is unrelated to calcium intake, a more likely explanation for this absent association is that the very low bone mineral density at the ultradistal wrist reduced the range of variation and precluded detection of differences.

Recently, Heaney, after accounting for methodological limitations in studies with negative results, argued that the literature supports a strong positive role for calcium in the prevention of age-related bone loss in women.[6] The protective effects of high dietary calcium intake on radial and spinal bone mineral density observed in this study were very similar to effects reported elsewhere.[3,10,16–18,22–24] Although we have found no other studies of milk consumption related to bone mineral density of hip sites, our findings are compatible with a previous report from this cohort in which 24-hour calcium intake was inversely related to risk of subsequent hip fracture.[19] This study lends further support to the importance of milk in the preservation of bone in women. □

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Attitudes toward Body Size and Dieting: Differences between Elderly Black and White Women

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ABSTRACT

Eating restraint and body size perceptions of 404 White and African-American women 66 to 105 years of age (mean age = 73 years) were assessed by questionnaire. Compared with overweight White women, overweight Black women were 0.6 times as likely to feel guilty after overeating, 0.4 times as likely to diet, 2.5 times as likely to be satisfied with their weight, and 2.7 times as likely to consider themselves attractive. Among those who were not overweight, Black women were half as likely as White women to consider themselves overweight. Compared with Black women, White women perceived themselves to be larger and reported a lower ideal body weight. (*Am J Public Health.* 1994;84: 1322–1325)

Introduction

The prevalence of obesity in African-American women is approximately twice that in White women.[1,2] Although the causes of this high Black–White ratio remain unclear, differences between African-American and White women in the motivation or ability to lose weight are probable contributing factors.[3–6]

Several researchers have reported differences in perceived or ideal body size in adolescent and college-aged African-American and White females.[5,7,8] Adult African-American women have also been shown to be less likely to think that being overweight is a problem[9] or to perceive themselves as overweight.[10] National data on the prevalence of weight loss attempts indicate that dieting patterns are similar among overweight African-American and White adult women and that, among women who are not overweight, dieting is less common in African Americans than in Whites.[10–14]

The purpose of this research was to examine attitudes toward eating and body size perceptions in elderly Black and White women. Reports of body size perceptions and eating restraint in elderly women are rare.[14] These attitudes, however, are relevant to older people in that they may influence the effectiveness of dietary interventions, including advice to lose or gain weight. Also, it is of interest to document attitudes toward eating and body size perceptions in Black and White women born at the turn of the century because there has been a secular change in societal pressures for thinness in American women.[15–18]

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