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Osteoporosis and Milk Intake among Korean Women in California: Relationship with Acculturation to U.S. Lifestyle

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Abstract

Background—The Korean population in the U.S. increased by a third between 2000 and 2010. Korean women in the U.S. report low calcium intake and relatively high rate of fractures. However, little is known about the prevalence of osteoporosis among Korean American women. This paper examined the relationship between prevalence of osteoporosis and milk consumption, and their relationship with acculturation among a representative sample of immigrant California women of Korean descent.

Methods—Bilingual telephone surveys were conducted from a probability sample (N = 590) in 2007.

Results—Lower acculturation significantly related to lower milk consumption for women during the age periods of 12-18 and 19-34 years. Acculturation was related to higher prevalence of osteoporosis among post-menopausal, but not pre-menopausal Korean women in California.

Discussion—Future research should include larger cohorts, objective measures of osteoporosis, other sources of calcium specific to Korean cuisine, and assessment of bone-loading physical activity.

Keywords

osteoporosis; milk; acculturation; Asian; Korean; women's health

Background

Osteoporosis and incidence of fractures are increasing in the U.S. and the world (1). In Korea, osteoporosis is the second most prevalent disease among women (2). Koreans are a

growing minority in the U.S.; their population in the U.S. increased by over a third between 2000 and 2010 (3). Korean women in the U.S. report low calcium intake and relatively high rates of fractures (4, 5). However, little is known about the prevalence of osteoporosis among Korean women in the U.S.

Theoretical framework

This study was informed by the behavioral ecological model (BEM), which is based on principles of behavior and hypothesizes that social contingencies of reinforcement define cultural practices and influence both individual and population behavior (6). The traditional diet of a culture is an example of learned behaviors passed between generations and is a function of the availability of specific foods in their environment.

Acculturation changes food consumption from traditional Korean to western-style diet, including more milk products (7, 8). More acculturated Koreans in the U.S. engage in more vigorous exercise than their traditional counterparts (9). Acculturation may affect osteoporosis through changes in calcium consumption and physical activity. The relationship between acculturation and osteoporosis has not been previously studied among Korean immigrants. The purpose of this study was to compare reported rates of osteoporosis by acculturation level for Korean women in California and to examine the relationship of acculturation with milk consumption and osteoporosis.

Methods

Data Collection and Participants

Telephone surveys were conducted by professional, bilingual interviewers in 2007. Participants were Californian women of Korean descent aged 18 years and older. The sampling frame involved randomly selecting households with one of 350 common Korean surnames from listed and unlisted telephone numbers. One adult women of Korean descent in the household was selected. If there were multiple adult women, the most recent birthday procedure was used to randomly select the participant from the eligible women in the household (10). The survey was written in English, translated into Korean, back translated, discussed in focus groups and reviewed by faculty in Korea. Interviewers confirmed participants' Korean descent and consented participants as approved by the Institutional Review Board at [blinded for review]. The response rate was 70% (completions/total eligible, N=590). 80% preferred to be interviewed exclusively in Korean.

Measures

Osteoporosis—Participants answered the standardized National Health and Nutrition Examination Survey (NHANES) question “Has a doctor ever said that you had osteoporosis” (11). Affirmative responses were coded as 1; otherwise coded as 0.

Milk consumption—Current and historical milk intake was collected from standardized NHANES questions. Milk intake was reported for three life periods - rapid bone building ages 12 -18, child-bearing ages 19-34, and ages 35 years (11, 12). Responses were dichotomized as consuming milk once or more per day for each life period.

Physical activity: Any physical activity in past month was dichotomized as 1 for any and 0 for none using standard BRFSS questions (13).

Acculturation: An acculturation scale was adapted from the Suinn-Lew Asian Self-Identity Acculturation Scale to enable telephone administration (10). The 10-item scale included

language ability; preferred language for speaking, reading, and music; ethnic breakdown of friends before the age of 6, between the ages of 6 and 18, and now; Korean self-identity; and percentage of education and life in the U.S. Verbatim wording is available in other publications (7, 10). A logarithm transformation was computed for the mean of the composite (Cronbach's $\alpha = .88$). Tertiles were calculated to create cells of equal sample size for descriptive analyses. Acculturation remained continuous in multivariate analyses. Additional measures related to acculturation but not included in the scale are age of immigration and whether the participant lived in the U.S. before age of 18.

Other Variables: Physiological and sociodemographic variables theoretically relevant to osteoporosis are listed in Table 1.

Analysis: Data were weighted by age of the Korean female population in the 2000 California census; unweighted analyses resulted in equivalent findings. Bivariate analyses included t-tests and chi-square tests. Multivariate logistic regressions for osteoporosis were stratified by menopause status.

Results

Most participants (93.5%) were born in Korea as were their parents (99.7%). 30.7% of the sample was post-menopausal. Post-menopausal women were older (61.2 years, SD = 10.3) and reported a higher body mass index (bmi) (22.9, SD= 2.7) than pre-menopausal women (34.6 years SD = 10.0 and BMI = 21.3 SD=2.9). Over 27% of the sample lived in the U.S. before the age of 18. The average age of immigration was 26.2 years (SD=14.3).

Osteoporosis—The prevalence of osteoporosis for Korean women in California 18 years of age was 7.4%; restricting the sample to women 50 years of age increased the prevalence to 21.3%. Osteoporosis was lower for pre-menopausal women (2.0%) than post-menopausal women (19.4%). Acculturation was not related to osteoporosis among pre-menopausal women. For post-menopausal women, osteoporosis was greater among those who were less acculturated (26.7%) than among those who reported medium (14.1%) or higher (5.2%) acculturation ($\chi^2 = 6.7, p = .03$). Table 1 shows bivariate associations. Women with osteoporosis were significantly less acculturated and less likely to have consumed 1 serving of milk when they were ages 12 to 18.

Table 2 presents multivariate logistic regressions removing highly collinear predictors stratified by menopausal status. Pre-menopausal women diagnosed with osteoporosis reported a significantly higher bmi and were significantly more likely to take calcium supplements than women not diagnosed. Post-menopausal women diagnosed with osteoporosis were significantly older and less acculturated than women not diagnosed with osteoporosis. Milk intake for women between the ages of 12 – 18 was not related to osteoporosis, even when acculturation was removed from the model.

Milk consumption—Table 1 shows univariate frequencies of independent variables as well as their bivariate association with drinking milk once per day between the ages 12-18. Approximately 30% of the overall sample drank milk at least once per day between the ages of 12 and 18. This percentage declined to 22.3% between ages 19 – 34, to 23.4% for ages 35 and to 26.2% for all ages currently. More acculturated Korean women were significantly more likely to consume milk at least once per day between the life periods of 12 to 18 and 19 to 34 than women less acculturated. Acculturation was not related to current milk consumption or milk consumed over the age of 35. Milk consumption between the ages 12-18 significantly correlated with milk consumption throughout life: ages 19-34 ($r = .528, p < .001$), ages 35+ ($r = .204, p < .001$) and current milk consumption ($r = .313, p < .001$). Women

who drank milk at least once per day between the ages of 12 and 18 were more likely to live in the U.S. during that age period than women who drank milk less than once per day.

Milk consumption between the ages of 12 and 18 was regressed on bmi, total education, calcium supplements and acculturation (data not shown). Higher education and acculturation remained significantly related to consumption of milk between the ages of 12 and 18 among Korean women in California. If acculturation was replaced with living in the U.S. before the age of 18, similar significant associations were observed with higher education and living in the U.S. before age 18 related to higher likelihood of consuming milk at least once per day between the ages of 12-18.

Analyses were repeated for current milk consumption (data not shown). Current milk consumption was significantly related to higher percent of education in the U.S., and drinking milk at least one time per day between the ages of 12-18 but was not related to acculturation or living in the U.S. under age 18 .

Discussion

Prevalence of osteoporosis among Korean women in California was not statistically different when compared with the 2007-2008 NHANES prevalence among U.S. women after age-standardization (9.8% among U.S. women ages 20+, and 19.8% among U.S. women 50+) (11). Lower acculturation was significantly related to higher reported osteoporosis among post-menopausal Korean women in California, even after adjustments in multivariate analyses.

Approximately 70% of Korean women did not drink milk at least once per day when they were between the ages of 12 and 18 which might increase their risk for osteoporosis. Higher acculturation and living in the U.S. before the age of 18 was significantly related to consuming at least one serving of milk per day between the ages of 12 and 18. However, milk consumption during these early years was significantly related to osteoporosis only in bivariate analyses. The significant effect was not retained in multivariate analyses possibly due to limitations of our measures or due to insufficient calcium consumption by participants to prevent osteoporosis.

Though acculturation was related to higher milk consumption during the younger life periods, it was not related to current consumption. Immigrants from Korea are exposed to more milk through the increased availability in stores and broader social acceptance in the U.S. Our findings suggest that acculturation plus availability of milk might interact to increase milk consumption during the younger life periods. Women's milk consumption in their mid-30s and beyond is not related to acculturation but rather to consumption during their earlier life periods.

Strengths and Limitations

We interviewed an under-studied, primarily Korean-speaking population. Reported lifetime milk intake and osteoporosis may have recall bias, but they are standardized NHANES questions (8, 9). We did not ask women if they had a bone scan to test for osteoporosis. Access and use of a bone scan might have confounded our significant relationship between acculturation and osteoporosis. However, NHANES does not ask women about receipt of bone scan. National NHANES data suggest that women under-report osteoporosis because they have not yet been diagnosed and that 2.5 times as many women might actually have the disease as compared to self-report (1). If this is true among Korean American women, the prevalence for osteoporosis would be even greater. Vigorous exercise was analyzed in the model but dropped from this manuscript because of its null relationship with osteoporosis.

Specific types of physical activity were not assessed in this study. A stronger relationship with osteoporosis may have been observed if bone-loading activity had been reported.

Future Directions

Future research should include larger cohorts, objective measures of osteoporosis, other sources of calcium specific to Korean cuisine, and assessment of bone-loading physical activity.

Osteoporosis screening should be a priority for Korean women who are less acculturated to U.S. Health programs should encourage low-fat milk consumption for the entire family because milk consumption early in life promotes life-long milk consumption. For persons lactose intolerant, other sources of calcium should be promoted. Adolescent periods are the most optimal periods for bone growth. Future studies should test the effects of promoting low-fat milk consumption for Korean American adolescents to increase current low rates, especially among those less acculturated or born outside of the U.S. Bilingual programs could be implemented cooperatively with venues that primarily serve Koreans such as clinics, schools, grocery stores and churches. Previous bone health interventions could be adapted for the Korean immigrant adolescent culture.

New contribution to the literature

This study was the first study to report the prevalence of osteoporosis among a representative sample of Korean women in California with limited English proficiency. Lower acculturation was significantly related to higher likelihood of osteoporosis among post-menopausal women, even after multivariable controls. Milk intake was related to acculturation, but only during younger ages. Osteoporosis screening should be a priority for Korean women who are less acculturated to U.S. Future programs should work with Korean families to increase low-fat milk consumption during childhood.

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Table 1

Univariate frequencies and bivariate analyses of independent variables with Osteoporosis and Milk Intake among Korean women in California, 2007. ^a

	Overall Sample (N=590)	Osteoporosis ^b		Drank Milk Once/Day Ages 12-18	
		Yes (N=44)	No (N=546)	Yes (N=174)	No (N=414)
		%	%	%	%
Born in U.S.	6.2	0.0	6.8	*11.5	4.1
Lived in U.S. by the age of 18	28.0%	*4.5%	29.9%	*38.7%	23.4%
Self-reported poor or very poor health	7.8	*20.9	6.7	*4.0	9.2
Insured	63.6	*81.4	62.2	*60.1	65.0
Currently Married	69.5	68.2	69.5	*60.0	72.5
Employed	35.1	*20.5	36.4	37.4	34.2
Menopausal	30.7	*62.2	26.6	*11.2	38.7
Consumed Milk 1+/Day					
Ages 12-18	29.4	*14.0	30.7	--	--
Ages 19-34	22.3	16.3	22.7	*56.0	7.9
Ages 35+	23.4	27.3	22.9	*40.0	18.9
Currently	26.2	27.3	26.1	*47.6	17.3
Daily calcium supplements	22.8	*55.8	20.1	*16.1	25.8
Any physical activity in the past month	68.1	*86.4	66.7	69.0	67.7
		<u>Mean (SD)</u>	<u>Mean (SD)</u>	<u>Mean (SD)</u>	<u>Mean (SD)</u>
Age	42.7 (15.9)	*64.0 (13.5)	41.4 (14.8)	*35.4 (12.0)	45.8 (16.3)
BMI	21.8 (2.9)	*23.3 (2.8)	21.7 (2.9)	*21.3 (3.2)	22.0 (2.8)
Number of visits to doctor last year	3.4 (4.9)	*7.3 (6.9)	3.0 (3.4)	3.3 (4.6)	3.5 (5.4)
Number of live births	2.1 (1.0)	*2.7 (1.4)	2.0 (.9)	*1.9 (1.1)	2.1 (1.0)
Acculturation to U.S. lifestyle ^c	-.044 (.3)	*-.324 (.3)	-.022 (.3)	*.045 (.3)	-.080 (.3)
Years of Education	15.2 (2.9)	*13.1 (4.4)	15.4 (2.7)	*16.0 (2.3)	14.9 (3.1)
Percent Education in U.S.	21.6 (32.9)	*9.5 (26.1)	22.6 (33.2)	*33.2 (38.7)	16.9 (28.9)
Years in the U.S	16.5 (10.2)	*22.2 (8.8)	16.1 (10.1)	*14.5 (9.7)	17.4 (10.3)
Percent life in the U.S.	40.2 (25.2)	36.6 (19.3)	40.5 (25.6)	*43.2 (30.1)	38.9 (22.7)
Age immigrated to U.S.	26.2 (14.3)	*41.7 (15.2)	25.0 (13.4)	*20.9 (13.4)	28.4 (14.0)

^aData were collected in 2007 for women ages 18 and over of Korean descent who resided in California. Values reported in the top portion of table represent percents while values reported in bottom portion of table represent means and standard deviations. An asterisk denotes significant difference at $p < .05$ levels and computing either a Chi-Square analyses or a t-test using ever diagnosed with osteoporosis as the outcome variable.

^bOsteoporosis is defined as "yes" if the participant provided an affirmative response to 'Has a doctor ever said that you have had osteoporosis?' and was coded as 1. Otherwise defined as no osteoporosis (coded as 0).

^cContinuous score on the acculturation scale. Higher scores correspond to higher assimilation to US lifestyle and lower scores correspond to adhering to more traditional Korean culture.

Table 2

Multi-variable analyses: Osteoporosis regressed on behavioral and biological predictors stratified by menopause status among Korean women in California, 2007 ^{a, b}

Predictor	Pre-Menopausal ^d		Menopausal ^e	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Age (years)	1.06 (0.98, 1.15)	.12	1.07 (1.02, 1.12)	.01
BMI (kg/m ²)	1.27 (1.02, 1.59)	.03	1.01 (0.87, 1.17)	.92
Drank milk at least once per day ages 12-18 ^b	1.86 (0.33, 10.6)	.48	1.02 (0.27, 3.88)	.98
Current calcium supplement use ^b	10.20 (1.77, 58.8)	.01	1.69 (0.72, 3.95)	.23
Any physical activity past month ^b	1.78 (0.26, 12.10)	.56	1.27 (0.39, 4.11)	.39
Acculturation to U.S. lifestyle ^c	0.302 (0.10, 0.927)	.49	0.17 (0.04, 0.79)	.02

^aNumbers in cells are adjusted odds ratios with calculated 95% confidence intervals, two-tailed probabilities. Values are weighted to the 2000 census age distribution of Koreans in California.

^bVariables are coded as yes (1) and no (0).

^cContinuous score on the acculturation scale. Higher scores correspond to higher assimilation to US lifestyle and lower scores correspond to adhering to more traditional Korean culture.

^dPre-menopausal model $X^2 = 22.5$, $df = 6$, $p < .001$; Nagelkerke $R^2 = .307$

^eMenopausal model $X^2 = 23.0$, $df = 6$, $p < .001$; Nagelkerke $R^2 = .201$