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**Are adolescent attitudes toward calcium-rich foods and intake of dietary calcium related to the presence of grandparent(s) living in the household?**

An Honors Project

Submitted to the College of Consumer and Family Sciences

Department of Foods and Nutrition

of

Purdue University

by

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## **Abstract**

**Introduction.** Early adolescents are a group at risk for reducing calcium intakes during a time of maximal bone accretion. Sociological research suggests that grandparents can positively influence their grandchildren's self esteem.

Therefore, this study hypothesized that early adolescents from households with a grandparent(s) would have a more positive attitude toward calcium-rich foods and a higher consumption of total calcium than their counterparts in households without a grandparent(s). **Methods.** This study used a cross-sectional design involving the administration of a questionnaire to a child (10 - 13 y) and a questionnaire to the adult responsible for food acquisition and preparation in the child's household. One criterion for inclusion was that parents self-identified as Asian, Hispanic, or non-Hispanic white (NHW). 533 children and 519 parents (517 parent/child dyads) completed questionnaires from 8 states. The respective questionnaires were designed to assess calcium intakes and psychosocial factors related to calcium-rich foods. For this analysis, only children with complete information on age, race/ethnicity, gender, and household composition were included (n=519). All analyses were conducted separately for each race/ethnic group (Asian=53, Hispanic=194, NHW=272). Dependent quantitative variables were compared using multivariate linear regression. **Results.** The differences in calcium intakes between those adolescents in grandparent households and those households without grandparents were not significantly different as were the psychosocial factors related to taste preferences for calcium-rich foods and healthy benefits of calcium-rich foods. However, among

NHW adolescents, those from grandparent households were less likely to perceive themselves as being intolerant to milk ( $p=.05$ ). **Conclusions.** Small sample sizes within each race/ethnic group may have limited the statistical power to find differences. Among the Asian and Hispanic households, results would suggest that grandparents have little influence with regard to calcium intakes. While the presence of a grandparent in a NHW household may positively influence factors related to enhancing calcium intakes.

## **Introduction**

Early adolescence is an important time for physiological development. Skeletal development at this time is especially important because it lays the foundation for an individual's bone health throughout his or her lifetime. Ailments such as childhood fractures and osteoporosis later in life remind us of the importance of healthy bones and having adequate bone mass. Medical expenses related to osteoporotic fractures were estimated to reach \$19 billion for the year 2005 alone. This staggering expense does not even include the cost of fractures sustained by children.

During a healthy adolescence, the skeleton grows dramatically as the long bones of the body lengthen and bone density increases. Adequate calcium along with vitamin D consumption allows the human body to build and maintain strong

bones. The Institute of Medicine has set the Adequate Intake (AI) for daily calcium intake to be 1300 mg for adolescent children (both males and females). Many children do not accomplish this intake. Researchers have investigated various factors which affect and relate to adolescent calcium consumption. Studies suggest that family, mainly parents, can influence adolescent calcium intake even beyond the scope of purchasing food.

Dairy products are considered the best food sources for calcium, thus researchers have focused on dairy product consumption and in particular milk consumption. One such study reported that girls who witnessed their fathers drinking milk were more likely to consume milk themselves. While another study found that girls who consumed the AI for calcium were more likely to have mothers that drank milk and served their children milk than girls who did not meet the AI.

Studies have also examined the influence of family structure on different activities and behaviors. Many anthropological studies have examined the influence of family structure on children's cognitive behaviors. Nutrition researchers have found that family structure can even have an influence on a child's dietary behavior, including energy and mineral intakes. Data from the US Census Bureau showed that children coming from families with 2 parents were less likely to be food insecure. Among teenage girls from low income households, Hertzler et al found a significant association between hematocrit

levels and dietary measures only in the girls reporting a low family structure.

This was not observed in the girls classified as living in a high family structure household.

Family structure and interaction has been examined as a potential factor influencing a variety of dietary behaviors, such as mineral intake (Hertzler) and food security (U.S. Census Bureau). However, studies often exclude multigenerational models. Anthropological data suggest that grandparent interactions with their grandchildren or intergenerational transmission can have a positive impact on adolescents' psychological well-being. This relationship has not been heavily investigated as related to dietary intakes. A qualitative analysis using focus groups with multigenerational family members concluded that grandparents were eager to have active roles in influencing the nutritional intakes of their grandchildren.

The purpose of this study is to examine the composition of the household as it relates to the attitudes adolescents hold toward calcium-rich foods and their consumption of calcium-rich foods. The hypothesis is that early adolescents from households with a grandparent(s) will have a more positive attitude toward calcium-rich foods and a higher consumption of total calcium than their counterparts in households without a grandparent(s). Ideally establishing relationships between having a grandparent in the household to total calcium intake and a relationship between each positive psychosocial factor to calcium

intake and the primary exposure (grandparent in household) will allow us to suggest the model shown Figure 1.

## **Methods**

### **Study design and sample recruitment**

This study used a cross-sectional design involving the administration of a questionnaire to a child aged 10 – 13 y and a questionnaire to the person responsible for food acquisition and preparation in the child's household. Participants were recruited using fliers, verbal announcements, written announcements in bulletins or newsletters, personal contacts, and presentations at groups. Organizations and groups approached for this study included Cooperative Extension Service (e.g., EFNEP, FSNEP, 4-H), faith-based groups, after-school programs, sports teams, scouting groups, and adult groups (e.g., ESL classes, employers, WIC).

Criteria for recruitment included that the adult respondent be the major food purchaser and preparer for household. In some instances the adult respondent was a relative or caregiver other than the parent. For simplicity, the adult respondent is referred to as "parent" from here out. Other criteria for recruitment included: parent and child must have lived in the US for at least 12 months; parent and child were able to read/speak English; and parent self-identified as non-Hispanic white (NHW), Hispanic or Latino, or Asian or Asian American, or a mixture of any of these three groups. A total of 533 children and 519 parents

representing 517 parent/child dyads completed questionnaires from 8 states (AZ,CA,CO,HI,MI,MN,OR,WA). The study protocols were approved by the Institutional Review Board of each participating university.

### **Administration of the Questionnaire**

Researchers distributed the questionnaires which were self-administered by parents or caregivers and self-administered by the children. Beyond basic instructions children were not assisted in answering questions.

Parents/caregivers took about 20-45 minutes to complete the questionnaire and children about 20-30 minutes. All questionnaires were completed in English.

### **Measures**

The You and Your Food questionnaires was developed to assess psychosocial factors influencing the consumption of calcium-rich foods among Asian, Hispanic, and NHW adolescents. The first part of the questionnaire, *How Do You Feel About What You Eat and Drink?*, addressed psychosocial constructs related to eating calcium-rich foods. The second half of the questionnaire, *What You Eat and Drink*, was a calcium-specific semi-quantitative food frequency questionnaire (FFQ) that has been evaluated for use with Asian, Hispanic, and NHW adolescents. Information about employment, age of the child, race/ethnic group, and gender of the child came from the parent questionnaire, unless the parent information was missing.

**Characteristics.** The questionnaires addressed various parent and child characteristics, respectively. The primary exposure, grandparent in the household, came from the child questionnaire. The children were asked, “Who lives in your home?” Any child that check “Grandmother(s)” or “Grandfather(s)” was classified as a child with a grandparent in the household. The child characteristics used were the child’s age, gender, and ethnicity while the parent characteristics of importance were parental employment and education. If the child questionnaire differed from his or her parent respondent’s questionnaire in regards to the child’s reported age or gender the parent information was used. If the matching parent questionnaire was missing, the child’s self-reported age and gender were used. Parental employment was coded as “employed” when the respondent adult checked employed part-time or full-time; while “unemployed” was used to signify the adult respondent being a student, unemployed, or retired. Education was divided into three groups. The first group was parent respondents who did not have a high school degree or its equivalent. The second group was parent respondents with high school degrees and maybe some college but not a 4-year college degree. The last group was parent respondents who had attained a four year college degree or higher. Ethnicity was based on the self-classification of the child. If the child checked Asian, Hispanic, or non-Hispanic white, then the child was classified as those respective groups whether another ethnic group was checked or not.

**Psychosocial Factors.** Themes addressing motivators, barriers, beliefs, habits and attitudes influencing the consumption of calcium-rich foods were extracted from focus groups involving Asian, Hispanic, and non-Hispanic white adolescent boys and girls as published previously {1896}. The Social Learning/Cognitive Theory provided the framework for the focus group analysis. Briefly, for personal expectations/expectancies, five scales emerged: taste, food associations, health, perceived milk intolerance, and choice/independence. A family scale and influence of others scale aligned with environment-social construct. Eating occasions, location, and media scales best identified the environment-physical construct. In a separate study, reliability was measured using internal consistency assessment (Cronbach's alpha) and test-retest reliability. The Cronbach's alpha coefficients of the scales ranged from .40 to .83; the majority being .70 or above. The test-retest reliability of the scales were found to be highly reliable over one week with Pearson correlation coefficients ranging from .44 to .76 and no significant differences between the first and second responses.

**Dietary Assessment.** Calcium intakes were estimated with a calcium-specific semiquantitative FFQ containing 79 foods or food groups representing calcium-rich foods of Asian, Hispanic, and non-Hispanic White youth. The FFQ asked individuals to recall what they had eaten or drunk over the past month. The FFQ had previously been evaluated as having satisfactory reliability ( $r=0.68$ ,  $P<0.001$ ) and accuracy compared with two 24-hour recalls ( $r=0.54$ ,  $P<0.001$ ) among adolescent Asian, Hispanic and non-Hispanic white girls and boys between 10

and 18 years old (Jensen et al). Details of the development and calculation methods for the FFQ have been previously published (Jensen et al). Estimated calcium intakes less than 100 mg and greater than 2500 mg were considered implausible. Therefore, these individuals were eliminated from any analysis involving calcium intakes.

### **Statistical Analysis**

Quantitative variables were evaluated as meeting the criteria for a normal distribution. No variables needed transformation. Categorical fields were compared using chi-square. Due to the distribution of grandparents being statistically significantly different between the ethnic groups, all analyses were conducted separately for each race/ethnic group. In separate models, multivariate linear regression was used to test the relationship of the independent variable (grandparent present) and the dependent variables: food calcium intake, calcium intake from dairy foods, calcium intake from milk, and the psychological factors which included attitudes and preferences related to calcium intake.

Analyses were adjusted for age (quantitative field), gender, the parent respondent's employment (at least one person employed part-time or more in the household or no one employed in the household), and the parent respondent's education (either no high school degree, no college degree but a high school degree, or both a high school and college degree).

### **Results**

A total of 7 questionnaires were eliminated due to the grandparent being the primary caregiver in the household. Five respondents identified themselves as an unclassifiable ethnic group, i.e., “other”. Two respondents were excluded due to age missing for one respondent and age out of range for another respondent. Therefore, the final sample size was 519 respondents. Characteristics of the 519 children are shown in Table 1. Thirty-nine children or 8% of the 519 had one or more grandparent present in the household. The proportion of grandparents reported as living in the home was significantly different between the ethnic groups (chi-square=13.21, df=2,  $P=.001$ ). The majority of the respondents were female (55%). The majority (40%) of the Asian respondents were 10 years old, whereas the majority of the Hispanic and non-Hispanic respondents were 13 years old as shown in Table 1.

Results of the multivariate analyses examining the association between the psychosocial factors and grandparent in the household by ethnic group is shown in Table 2. Among the Asian ethnic group, there were no significant differences in psychosocial constructs between adolescents with or without a grandparent present in the household. The Hispanic children living in households with grandparents were significantly less likely to report CRF's had a positive taste and significantly more likely to report beverage independence than their ethnic peers in non-grandparent households. The NHW children in grandparent households, were more likely to perceive themselves as being intolerant to milk compared to those children without a grandparent in the household.

There were 24 calcium intakes classified as outliers (24/519; 5%). None of the Asian respondents were considered outliers, whereas 13 or 7% of the Hispanic respondents were outliers and 11 or 4% of the non-Hispanic white respondents. Thus, for the analyses of calcium intakes, the sample size was 53 for the Asian children, 181 for the Hispanic children, and 261 for the non-Hispanic white children. As shown in Table 3, none of the calcium intakes differed between the respondents with grandparents in their households and those without grandparents in their households. This was true for each ethnic group.

## **Discussion**

The results of this study were contrary to the original hypothesis, in that, calcium intakes among early adolescents were not affected by having a grandparent present in the household. Hierarchical modeling could not be established. The multivariate analysis showed no significant relationship between having a grandparent in the household and adolescent calcium intake. Further, asserting that households of all ethnic groups with a grandparent present would foster significantly more positive attitudes toward the consumption of calcium-rich foods was not found to be the case. All statistically significant associations between a grandparent in the household and the child's attitudes and preferences were negatively associated with attitudes toward calcium consumption. For instance the Hispanic children with grandparents in their households were more likely to describe the taste of milk and milk with foods negatively; which is consistent with

them also reporting a greater independence in not having to drink milk. Based on these negative attitudes toward milk, the expectation would be that the calcium intakes would be lower among the Hispanic children with a grandparent in the household compared to their counterparts. However, this was not the case; there were no significant differences in calcium intakes.

The results from this study among the Hispanic early adolescents are hard to explain, since results of previous studies would suggest differently. When Guendelman and Abrams looked at the adequacy of nutrient intakes across first and second generation Mexican-Americans versus non-Hispanic white Americans, the first generation Mexican-Americans had the highest average intake of calcium despite having the lowest socioeconomic status. The authors suggested that as the Hispanic families of Mexican origin acculturate to living in the United States their eating tendencies change, causing them to consume less CRF. Ideally, if a Hispanic grandparent ensconced a traditional Mexican diet, having this grandparent in the household would support positive attitudes towards CRF's in their adolescent Hispanic grandchildren. In the present study, information was not available as to whether or not the grandparents of the Hispanic early adolescents advocated a traditional Mexican diet. Likely other factors played a greater role in Hispanic adolescent calcium consumption than having grandparents present in the household.

Non-Hispanic white adolescents from grandparent households were significantly more likely to report themselves as being intolerant to milk. Perceived milk intolerance has been shown to have detrimental effects on calcium consumption and bone status of early adolescent girls when most of the girls with perceived milk intolerance were not found to have lactose maldigestion (Matlik et al). One important question is how adolescents can perceive themselves as being milk intolerant when in lab settings they are asymptomatic. The results of the present study would suggest that the grandparent's influence about attitudes toward milk intolerance may be a contributor. Among of sample of telephone respondents between 60 and 94 years of age, 18% perceived themselves as being milk intolerant (Elbon et al) and this was also found to be negatively associated with milk consumption. Thus, individuals in the same age as most grandparents may perceive themselves as being milk intolerant and pass this attitude on to their grandchildren through intergenerational value transmission. This is an important issue to address because dietary habits developed early in life could influence a lifetime of calcium intake (Carroccio et al). Since the significant positive association between presence of a grandparent in the household and perceived milk intolerance was not accompanied by a significant difference in calcium intakes, other factors in the household or the child's environment are more influential with regard to overall calcium intake.

Ironically, among the Asian early adolescents no discernible differences were observed between the grandparent and non-grandparent households on calcium

intakes or the psychosocial factors associated with calcium intakes. This is surprising since Asian-Americans have a history of viewing themselves as being lactose intolerant (Jackson et al). Also, milk and other CRF's are not usually viewed as traditional Asian beverages, thus one might expect the grandparents to not promote consumption of milk and other dairy foods.

There are several limitations and strengths with this study. For this secondary analysis, the questionnaire was not designed to establish the role of the grandparent in the household. Future research could benefit by including questions regarding grandparents' roles in the households from both the grandchildren and the grandparents' perspectives. This additional information, accompanied by a larger sample size, may provide clarity as to the differences observed between ethnic groups.

## **Conclusion**

These results from this sample of early adolescents would suggest that grandparents living in the household have no influence over consumption of dietary calcium. However, early adolescents living in households with grandparents were observed to have significantly different attitudes, beliefs, and preferences with regard to consumption of CRF. Among Hispanic and Non-Hispanic white households, these influences would likely discourage consumption of CRF. Intergenerational transmission of dietary attitudes, beliefs, and perceptions is likely different across ethnic backgrounds.

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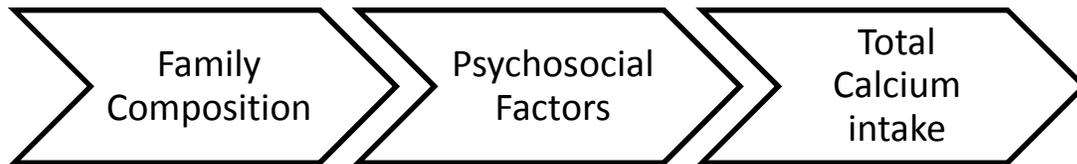
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## Tables and Figures

**Figure 1.**



Model of hypothetical the influence of a grandparent in the household influencing an early adolescent's attitudes, preferences, beliefs, perceptions about calcium rich foods which would positively affect calcium intake.

**Table 1.** Characteristics of early adolescents, ages 10-13 y, completing the You and Your Food questionnaire

	Asian (n=53)	Hispanic (n=194)	Non-Hispanic white (n=272)	Total (n=519)
	← n (%) →			
Grandparent in household, yes**	8 (15)	21 (11)	10 (4)	39 (8)
Gender				
Boys	24 (45)	76 (39)	132 (49)	232 (45)
Girls	29 (55)	118 (61)	140 (52)	287 (55)
Age, y**				
10	21 (40)	38 (20)	47 (17)	106 (20)
11	12 (23)	51 (26)	75 (28)	138 (27)
12	7 (13)	31 (16)	66 (24)	104 (20)
13	13 (24)	74 (38)	84 (31)	171 (33)

\*\*Grandparent,  $P=.001$ ; Age,  $P=.003$

**Table 2.** Adjusted mean differences between adolescents (10-13 y) with and without grandparents in the household of psychosocial factors related to consumption of calcium-rich foods (CRF) by ethnicity<sup>a,b</sup>

	Asian (n=53)	Hispanic (n=194)	Non-Hispanic white (n=272)
<b>Attitudes and preferences</b>			
Positive taste for CRF	-.10	-.26*	.03
t-value, p-value	-.37, .71	-2.26, .02	.16, .88
Preference for flavored milk	.08	.22	.06
t-value, p-value	.16, .87	1.08, .28	.18, .86
CRF are healthy	.15	-.17	.07
t-value, p-value	.41, .68	-1.00, .31	.31, .78
Food associations	-.26	-.21	-.04
t-value, p-value	-.70, .49	-1.45, .15	-.18, .86
CRF causes weight gain	-.41	.32	.10
t-value, p-value	-1.19, .24	1.62, .106	.46, .64
Perceived milk intolerance	-.07	.07	.43*
t-value, p-value	-.31, .76	.55, .59	2.29, .02
Beverage independence	.34	.44*	-.15
t-value, p-value	.56, .58	2.08, .04	-.49, .63
<b>Social/environmental factors</b>			
Family Influence	-.35	-.21	.26
t-value, p-value	-1.06, .30	-1.02, .31	1.07, .29
Family drinks milk	-.54	-.27	.33
t-value, p-value	-1.26, .21	-1.00, .34	1.00, .33
Family expectations	-.37	-0.10	.07
t-value, p-value	-.84, .41	-.45, .66	.21, .84
Meal eating occasion	.12	-.29	.03
t-value, p-value	.29, .77	-1.62, .11	.13, .89
School	-.25	.12	-.42
t-value, p-value	-.58, .56	.70, .49	-1.30, .19
Restaurant	-.08	.268	-.13
t-value, p-value	-.16, .88	1.22, .22	-.38, .70
Availability of calcium foods	-.50	.18	.17
t-value, p-value	-1.45, .16	1.64, .10	1.06, .29

\*  $P < .05$

<sup>a</sup>Adjusted for age, gender, parental employment, parental education

<sup>b</sup>Positive value represents a more favorable attitude, belief, or perception toward calcium-rich foods and a negative value represents a less favorable attitude, belief or perception; except in the case of perceived milk intolerance.

**Table 3.** Adjusted mean differences in estimated calcium intakes between children with and without grandparents in the household by ethnicity<sup>a, b</sup>

	Asian (n=53)	Hispanic (n=181)	Non-Hispanic white (n=261)
Dietary calcium/day (mg)	-134	129	34
T-value, p-value	-.66, .52	.77, .44	.22, .83
Dairy calcium/day (mg)	-180	110	72
T-value, p-value	-1.15, .26	1.00, .32	.53, .60
Calcium from milk/day (mg)	-123	71	137
T-value, p-value	-.84, .41	.99, .33	1.16, .25

<sup>a</sup>Adjusted for age, gender, parent (respondent) employment, and parent (respondent) education

<sup>b</sup>Positive value represents a higher calcium intake among those children with a grandparent(s) in the household.