Vitamin K Content of Hispanic Foods

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Abstract

To provide a food composition database for nutrition studies of Hispanics—the largest and fastest growing minority group in the United States—NDL initiated an increase in the number of Hispanic foods in the USDA National Nutrient Database for Standard Reference. In the initial collections, samples of 21 foods were obtained from four Hispanic Community Health Study (HCHS) locations (Bronx-NY, Miami, San Diego, and Chicago) plus the location of the study diet center (Minneapolis). In 2009, a sampling plan with 12 locations, based on the Hispanic population of the U.S., was developed. Foods were identified from focus groups conducted with first generation immigrants from Cuba, Mexico, the Dominican Republic, and Puerto Rico, plus suggestions from the HCHS Diet Committee. Selected foods (19) were purchased from restaurants and markets in the 12 locations, composited at Virginia Tech, and sent to the Vitamin K Laboratory at the USDA Human Nutrition Research Center on Aging for analysis. Phylloquinone content of the food samples was determined by reversed-phase high-performance liquid chromatography (HPLC). Phylloquinone values for plantain chips (29 mcg/100g) were higher than potato chips (22 mcg/100g). Other foods, like empanadas, showed variation (2-13 mcg/100g). These data will facilitate assessing the vitamin K intake of Latinos in large national studies such as the HCHS and NHANES. Funding: USDA and NIH, Agreement No. Y1CN5010.

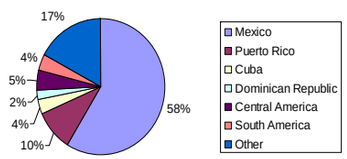
Introduction

Hispanics represent one of the fastest growing minority groups in the United States and represent a number of diverse cultures from different countries in the Americas (Figure 1). These cultural differences are reflected in the foods they eat and how they are prepared.

USDA's Nutrient Data Laboratory maintains the USDA National Nutrient Database for Standard Reference, which includes mainstream and ethnic foods. To improve the coverage of foods consumed by Hispanics, NDL has increased the number of Hispanic foods analyzed as part of its National Food and Nutrient Analysis Program (NFNAP) (Haytowitz *et al*, 2008). These data will support NIH's Hispanic Community Health Study and the What We Eat in America component of NHANES, as well as other studies.

Objective: Obtain data on content of Hispanic foods for two dietary forms of vitamin K--phylloquinone (the predominant form) and dihydrophylloquinone (a dietary form associated with hydrogenation of plant oils).

Figure 1. U.S. Hispanic population by country of origin.
Source: U.S. Census (2006)



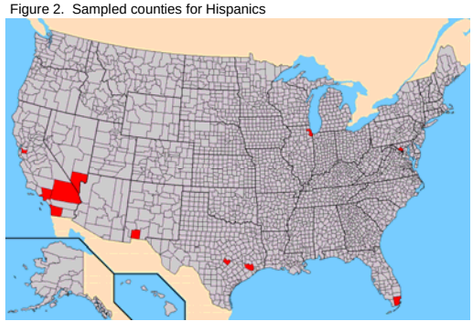
Methods

This study used the infrastructure established for the NFNAP, which incorporates procedures to:
1) prioritize foods and nutrients for analysis;
2) develop statistically valid sampling plans;
3) analyze food samples at qualified analytical laboratories; and
4) maintain a rigorous quality control program.

Sampling:
- Initial sampling of 21 foods from four Hispanic Community Health Study (HCHS) locations and the study diet center (Minneapolis), selected based on the size of the respective origins of their Hispanic communities:
  - Bronx-NY (Puerto Rican, 55%; Dominican, 25%)
  - Miami (Cuban, >70%; Central/South American, 25%)
  - San Diego (Mexican, >90%)
  - Chicago (Mexican, ~50%; Puerto Rican, 30%; Central/South American, 15%)
- New sampling plan developed in 2009 based on geographic distribution of the Hispanic population (Figure 2).
  - Sample proportioned to four census regions according to their size
  - Proportioned among 12 counties nationwide within census regions according to their Hispanic population

Sample preparation and analysis:
- Samples obtained from Hispanic retail outlets and restaurants in the selected counties;
- Samples shipped overnight to the Food Analysis Laboratory Control Center (FALCC) at Virginia Polytechnic Institute and State University;
- Foods weighed and measured;
- Composites prepared according to NDL instructions and homogenized;
- Samples packed under nitrogen and shipped frozen to the Vitamin K Laboratory at Tufts University, Boston, MA.
- Samples analyzed for phylloquinone and dihydrophylloquinone by HPLC, as described by Booth *et al.* (1994).

Figure 2. Sampled counties for Hispanics



Jackfruit

Tamale

Queso fresco

Table 1. Phylloquinone Content of Hispanic Mixed Dishes and Entrees (µg/100 g)

Food	Mean	n	S.D.*	Range
Arepa	3.5	4	4.0	0.0 – 9.2
Pupusas, beans	7.4	3	3.0	4.2 – 10.2
Pupusas, cheese	1.7	3	0.9	0.8 - 2.6
Pupusas, pork	1.1	3	1.0	0.4 – 2.2
Empanadas	6.2	3	6.1	2.0-13.2
Tamales, corn	5.4	2		1.1-12.0
Tamales, pork	5.1	2		2.6 – 7.6
Arroz con pollo (chicken and rice)	4.0	5	1.7	1.6 – 6.0
Arroz con frijoles negros (rice and black beans)	10.4	2		5.0 – 15.7
Arroz con gandules (rice and pigeon peas)	12.6	1		
arroz con habichuelas colorados (rice and red beans)	7.8	2		4.0 – 11.5
Black bean soup	6.0	2		5.1 – 6.9
Tripe soup	2.3	3	1.4	0.8 – 3.4

*** Standard deviations (S.D.) were not calculated for foods that had two or fewer samples for analysis.**

Table 2. Phylloquinone Content of Hispanic Baked Goods (µg/100 g)

Food	Mean	n	S.D.*	Range
Bunuelos, sweet	25.8	3	20.7	11.8 – 49.6
Galeta cremosa, piraque	5.4	2		2.2 – 8.6
Galeta salada cremosa, sabrosas	17.9	4	2.4	16.3 – 21.4
Pan dulce	1.6	2		1.6 – 1.8
Pastelitos de guava	12.4	2		11.3 – 13.6
Sugar wafers	2.1	4	0.1	1.95 – 2.15

*** Standard deviations (S.D.) were not calculated for foods that had two or fewer samples for analysis.**

Table 3. Phylloquinone Content of Hispanic Fruits and Fruit Snacks (µg/100 g)

Food	Mean	n	S.D.*	Range
Cherimoya	3.2	1		
Jackfruit	1.2	1		
Mango	11.5	1		
Nance, frozen	11.9	3	2.0	11.2 – 14.5
Naranjilla pulp, frozen	14.6	2		11.5 – 17.6
Papaya	0.2	1		
Papaya en conserva	0.3	1		
Plantain, fried	31.8	1		
Plantain chips	28.6	2		23.9 – 33.4
Sapote, mamey	1.5	1		
Yucca chips	5.3	1		

*** Standard deviations (S.D.) were not calculated for foods that had two or fewer samples for analysis.**

Table 4. Phylloquinone Content of Hispanic Cheese (µg/100 g)

Food	Mean	n	S.D.*	Range
Queso blanco	1.6	2		1.4 – 1.8
Queso fresco	1.0	1		
Queso seco	1.6	2		1.6 – 1.6

*** Standard deviations (S.D.) were not calculated for foods that had two or fewer samples for analysis.**

Pupusas

Empanadas

Results

- Major Vitamin K contributors: While all of the Hispanic foods analyzed contain varying levels of phylloquinones, baked products (Table 2) and fruit snacks (Table 3) generally contain the highest concentrations compared to other food groups.
- Variability: Considerable variability was observed in some of the Hispanic mixed-dish samples, with the values for arroz con frijoles negros (rice with black beans) ranging from 5.0 to 15.7 µg/100g (Table 1). The type and amount of phylloquinone-rich oils and other ingredients may explain this variability.
- Comparability: Hispanic cheeses (Table 4) contained similar levels of phylloquinone compared to common cheeses in the U.S. diet. Vitamin K values for fruits commonly consumed by Hispanics ranged from 0.2 µg/100g for papaya to 14.6 µg/100g for naranjilla pulp (Table 2).
- Vitamin K conversion product: Most samples did not contain any dihydrophylloquinone, which is formed from phylloquinone when oils are partially hydrogenated. Empanadas from New York and Miami contained 10.0 and 7.1 µg/100g of dihydrophylloquinone respectively, while none was detected in the other empanada samples.

Conclusion

- A number of foods popular among Hispanics may contribute significant amounts of Vitamin K. For example ½ cup of fried plantains can provide over 20% of the AI for men (AI = 120 µg) and 30% for women (AI = 90 µg).
- Samples were collected from Hispanic restaurants and retail outlets in different cities where Hispanic populations have migrated from different areas of the Americas and their foods reflect their heritage and style of cooking. However, it is not possible to attribute the variability seen in the values due to the limited sampling at each location.
- These data have been added to the USDA National Nutrient Database for Standard Reference and is available on NDL's Web site: http://www.ars.usda.gov/nutrientdata.

References

Booth, SL, Davidson, KW, and Sadowski, JA. (1994). Evaluation of an HPLC method for the determination of phylloquinone (vitamin K1) in various food matrices. *J. Agric. Food Chem.* 42, 295-300.

Bureau of the Census, U.S. Department of Commerce. 2006. U.S. Census. http://www.census.gov

Haytowitz, D.B., Pehrsson, P.R., and Holden, J.M. 2008. The National Food and Nutrient Analysis Program: A Decade of Progress. Journal of Food Composition and Analysis 21(Supp. 1):S94-S102.

Pehrsson PR, Haytowitz DB, Holden JM. 2003. The USDA's National Food and Nutrient Analysis Program: Update 2002. *J. Food Comp. Anal.* 16, 331-341.