

Phylloquinone (Vitamin K) and dihydrophyloquinone content of fast food pizza

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Abstract

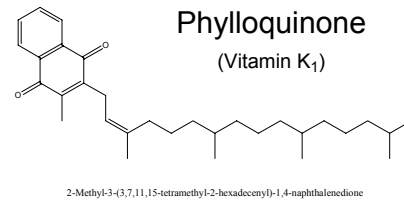
Phylloquinone (Vitamin K) is involved in blood coagulation. It may also play a role in protecting against osteoporosis as adults with reduced bone mineral density have lower intakes of phylloquinone. While pizza is a very popular and highly consumed food, little data are available on its vitamin K content. The objective of this research is to generate nationally representative vitamin K values for fast food pizza. These data will update and expand the USDA vitamin K database, first released in 1994 and now part of the USDA National Nutrient Database for Standard Reference (SR). Sample units were collected at 12 locations in the US from four fast food pizza restaurants. Samples included both thin and thick crust pizzas. Plain cheese, pepperoni, and deluxe (meat and vegetables) types were sampled. The composites were prepared and shipped to the Vitamin K Laboratory at the Jean Mayer Human Nutrition Research Center on Aging for analysis. Phylloquinone was determined by reversed-phase HPLC with fluorescence detection. The phylloquinone content of selected fast food pizzas ranged from 5.2 to 19.4 mcg/100g. The toppings selected did not have a large effect on the vitamin K content; however selecting toppings high in vitamin K, such as spinach or broccoli does increase the vitamin K content. Although pizza contains relatively small amounts of vitamin K compared to richer sources of vitamin K, such as green vegetables, the amount of pizza consumed, can make a contribution to the dietary intake of vitamin K. Based on this study, there are more dietary sources of vitamin K in the U.S. food supply than previously thought. The values on the phylloquinone content of fast food pizzas, along with those for other foods, will be added to USDA Databases. These values will enable investigators to monitor dietary intakes of phylloquinone, and to assess the impact of vitamin K intake on specific health conditions.

Introduction

- Vitamin K (Fig. 1), a fat-soluble vitamin, is essential for proper blood coagulation. Patients on oral anticoagulants are advised to consume a constant intake of phylloquinone, which is the predominate form of vitamin K in food.
- While phylloquinone is found in the highest concentrations in dark green leafy vegetables, and some plant oils (e.g. soybean), pizza is a highly consumed food and can make significant contributions of vitamin K to the diet. However, the food composition data are limited.
- Reported average phylloquinone intakes are low among adults in the U.S.:

	MEN	WOMEN
Adequate Intake (mcg/day):	120	90
Mean Intake (mcg/day):	80	73
- Low vitamin K intake may lead to:
 - Decreased Bone Mineral Density (BMD)
 - Increased incidence of hip fracture

Figure 1



Methods

Sampling:

- Probability proportional to size
- 4 regions (~equal population) (Figure 2)
- 3 strata per region (diverse population sizes)
- 1 general Consolidated Metropolitan Statistical Area (gCMSA) per strata
- 2 counties per gCMSA (rural and urban)
- 4 major pizza chains
- Various pizza types at each chain

Reference: Pehrsson et al, 2000.

Sample preparation:

- Shipped overnight to the Food Analysis Laboratory Control Center (FALCC) at Virginia Polytechnic Institute and State University in Blacksburg, Virginia.
- Pizzas weighed and measured
- Composites prepared using 1 slice (1/8 pizza) randomly selected from each pizza and homogenized
- Samples were packed under nitrogen and shipped frozen to the Vitamin K Laboratory at Tufts University, Boston, Massachusetts.

Analysis Method:

- Extracted vitamin K with hexane
- Purified with solid phase extraction using silica columns
- Quantitate using HPLC with chemical reduction and fluorescence detection
- Correct for losses using vitamin K₁₍₂₅₎ as internal standard

Reference: Booth et al, 1994.

The General Linear Method (GLM) was used to determine significant difference using SAS system (Version 8.2, SAS Institute, Cary, NC)

Figure 2

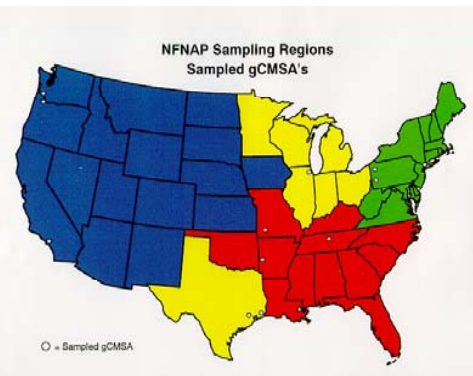
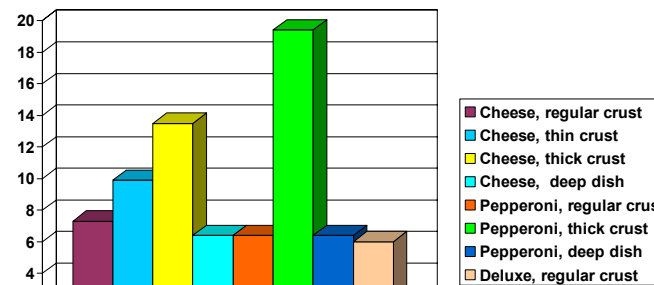


Table 1. Vitamin K (phylloquinone) content of fast food pizza (mcg/100 g).

Pizza	Chain	Mean	N	SD	Min	Max
Cheese, regular crust	Domino's®	5.4 ^a	4	0.52	4.7	5.9
	Little Ceasars®	5.9 ^a	3	0.26	5.7	6.2
	Pizza Hut®	10.1 ^b	4	2.86	7.8	14.1
	Papa John's®	7.6 ^b	4	0.77	6.7	8.3
Cheese, thin crust	Domino's®	15.8 ^a	4	2.08	13.1	18.0
	Pizza Hut®	8.3 ^b	4	0.98	6.9	9.2
	Papa John's®	5.6 ^b	4	0.59	5.2	6.5
Cheese, thick crust	Little Ceasars®	9.6 ^a	2		8.5	10.6
	Pizza Hut®	15.5 ^a	4	4.46	12.2	21.9
Cheese, deep dish	Domino's®	6.1 ^a	3	0.92	5.1	6.9
	Little Ceasars®	6.8 ^a	3	1.54	5.0	7.8
Pepperoni, regular crust	Domino's®	5.2 ^a	4	0.22	4.9	5.4
	Little Ceasars®	5.9 ^a	3	0.87	4.9	6.5
	Pizza Hut®	8.5 ^b	4	0.87	7.5	9.3
	Papa John's®	6.1 ^a	4	0.92	5.1	6.9
Pepperoni, thick crust	Pizza Hut®	19.4	4	1.80	17.2	21.2
Pepperoni, deep dish	Domino's®	5.9 ^a	4	0.55	5.1	6.2
	Little Ceasar	7.1 ^a	3	1.45	5.6	8.5
	Domino's®	5.2 ^a	4	0.64	4.6	6.1
Deluxe (meat and vegetable), regular crust	Domino's®	5.7 ^a	3	0.66	5.0	6.3
	Pizza Hut®	7.3 ^b	4	0.87	6.7	8.6
	Papa John's®	5.6 ^a	4	0.45	5.0	6.1

^{a,b} means with the same letter are not significantly different (P>0.05) between chains within pizza types



Discussion

Thick crust pepperoni had the highest mean vitamin K value (19.4 mcg/100g), while deep dish cheese, regular crust pepperoni, deep dish pepperoni, and regular crust deluxe pizza had mean vitamin K values of ~6 mcg/100 g (Fig. 3)

There is a significant difference (P > 0.05) between chains for the following types of pizza:

- cheese, thin crust
- cheese, regular crust
- pepperoni, regular crust
- deluxe, regular crust

No significant difference (P > 0.05) was observed between chains for the following types:

- cheese, thick crust
- cheese, deep dish
- pepperoni, deep dish

Vitamin K in pizza ranged from 5.2 mcg/100g in Domino's® regular crust pepperoni to 19.4 mcg/100g in Pizza Hut® thick crust pepperoni (Table 1).

Dihydrophyloquinone, which is formed by hydrogenation of phylloquinone during cooking, was not detected in most of the pizza analyzed, with the exception of Papa John's® thin crust cheese (11.5 mcg/100 g), Pizza Hut® regular crust cheese (0.05 mcg/100 g), Domino's® deep dish cheese (4.1 mcg/100 g), and Domino's® deep dish pepperoni (3.2 mcg/100 g).

A slice (1/8 15" pie = 98 g) of cheese pizza, regular crust contains 5.4 mcg of vitamin K, while a slice (1/8 15" pie = 111g) of thick crust pepperoni contains 23.9 mcg of vitamin K. While the pizzas analyzed in this study do not contain large amounts of vitamin K, they are very popular and therefore can make a significant contribution of vitamin K to the diet. Selecting toppings high in vitamin K such as broccoli (93 mcg/½ cup) or spinach (551 mcg/½ cup) would significantly increase the vitamin K content of this popular meal.

References

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