Dietary Differences among Women of Polish Descent in the United States by Country of Birth and Level of Education

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INTRODUCTION

Rates of breast and stomach cancer vary more than fivefold around the world with large differences observed for Polish immigrants as they move from Poland to the United States (Prentice et al., 1988; Staszewski and Haenszel, 1965). Similar trends can be found with regard to coronary artery disease suggesting that environmental factors may be important in the etiologies in these diseases (Lilienfeld et al., 1972; Toniolo et al., 1989). The United States Census of 2000 lists 8,977,444 persons of Polish ancestry, with Illinois the second most populous state for Polish ancestry. Over the past 40 years the breast cancer age standardized mortality rate in women increased threefold in Poland, while it has changed little in the United States. Despite these changes, breast cancer mortality is still 30% greater in the US than in Poland. Conversely, gastric cancer rates in Poland are about three times higher than in the United States (World Health Organization, 2002a) while the age standardized mortality for ischemic heart disease in Poland is only about 60% of that in the US (World Health Organization, 2002b). Data for Polish American disease incidence is generally not separated from other Caucasians, but studies of other immigrant groups, such as the Japanese, have demonstrated that incidence of breast cancer and coronary disease over time begins to approximate that of the country of migration (Deapen et al., 2002; Rodrigues et al., 1994). Determination of dietary and other lifestyle changes by country of birth and education level in a population undergoing changes in cancer and cardiovascular disease risk may provide clues to etiologic factors for these diseases.

Dietary factors implicated as etiologies for breast cancer include polyunsaturated fats, linoleic acid, saturated fats, breads, cereals, cakes and desserts, refined sugars and ethanol (Adlercruetz, 1990; Franceschi et al., 1997; Hargreaves et al., 1997; Herlzlsouer and Couzi, 1995; Hunter, 1996; Hursting et al., 1990; Landa et al., 1994; Velie et al., 2000). Dietary factors which may protect against breast cancer include fiber, monounsaturated fat, olive and seed oils, fruits, vegetables, vitamin A, beta carotene, and vitamin C (Franceschi et al., 1997; Landa et al., 1994; Prentice et al., 1988; Velie et al., 2000). The mechanism of these factors causing breast cancer might be related to their effect on steroids. Ethanol intake alters estrogen metabolism, while fiber may lower circulating levels of estrogen, androstenedione, or testosterone (Adlercruetz, 1990; Hargreaves et al., 1997; Hursting et al., 1990). Dietary fat might modulate the production, metabolism, or excretion of endogenous estrogen (Herlzlsouer and Couzi, 1995). Foods, and micronutrients and food components which may protect against gastric cancer include green, leafy vegetables, citrus and other fruits, onions, garlic, leeks, carotenoids, selenium and vitamins C and E (Boeing et al., 1991; Kono and Hirohata, 1996; Steinmetz and Potter, 1991). Foods that may contribute to gastric cancer are those high in salt and nitrates, and preserved foods, including processed and smoked meats, dried, salted and smoked fish and pickled foods (Hensrud and Heimburger, 1998). Urinary salt concentration is correlated with gastric cancer incidence (Joossens et al., 1996). Salt may also cause atrophic gastritis, which is associated with gastric cancer (Walker et al., 1971). The role of nitrates in causing gastric cancer is thought to be due to their breakdown into carcinogenic N-nitroso compounds (Mirvish, 1983). Other suggested etiologies for gastric cancer are *Helicobacter pylori* infection and cigarette smoking (Kneller et al., 1991; Tsugane et al., 1991). For coronary arterial disease, diets high in animal fat, total fat, saturated fat and low in antioxidants have been implicated as potential etiologies (Gerhard et al., 1999; Gylling and Miettinen, 2001; Rutledge et al., 1999).

Migrant studies have been useful in suggesting specific variables possibly affecting cancer risk. In an analysis of mortality among foreign-born Americans, standardized mortality rates for stomach cancer were higher for men from Poland than for any other European country (Haenszel, 1961). Studies of migration from high risk (Poland) to low risk countries (United States) have shown that stomach cancer rates among first generation migrants resemble those of the parent country, while second generation migrants tend to have rates closer to those of the host country

(Howson et al., 1986). The incidence of gastric cancer has decreased over the last few decades in most of the world, and in the United States since the 1930s. This has been attributed to improved food preservation and dietary changes (Hensrud and Heimburger, 1998). Gastric cancer age standardized mortality rates among women have decreased over over 100% during the past 40 years in the US and Poland, though there is still a three times higher risk in Poland. Studies of the effects of migration on relevant dietary variables in Polish women in the United States could provide important clues about the etiologies of certain chronic diseases.

METHODS

Data for this study were collected from women of Polish ancestry aged 17-81 living in the greater Chicago area. Women were largely recruited from Polish women's social groups. To be eligible, women had to have either at least one parent of Polish descent, or to have been born in Poland; women included both immigrants and persons born in the United States. The study protocol was approved by the Institutional Review Boards of Northwestern University and the University of Illinois at Chicago.

Dietary intake data were collected using a modified NCI Health Habits and History Questionnaire (HHHQ-DIETSYS Analysis Software, Version 3.4, National Cancer Institute, 1995), a well established public domain food frequency measure often used in cancer epidemiology. A modified questionnaire which included Polish foods and was developed by a Polish-American registered dietitian. The original HHHQ instrument included 100 food items, and an additional 28 Polish foods were added, primarily in the meats (including salted and pickled), vegetables, and breads and grains groups. The serving sizes of the original questionnaire were preserved for the modified food frequency. Cookbooks and Chicago Polish restaurant menus also were reviewed to identify additional significant foods, and the final questionnaire was reviewed by several Polish-Americans familiar with cooking and food purchasing. These reviews indicated that the food frequency had face and content validity. The food list was bilingual, although there were separate questionnaires for English and Polish language participants. The DIETSYS food composition database of the HHHQ contained values for all but 24 of the items in the modified questionnaire; values for these foods were added to the DIETSYS database using data from the NDS (Nutrition Data System, Version 2.91, 1997, Nutrition Coordinating Center, University of Minnesota; Minneapolis, MN).

Body Mass Index (BMI) was calculated from self reported weight and height for each participant. Other data collected from the questionnaire included smoking history, marital status, and languages spoken. The questionnaire also included questions regarding dietary supplements.

The questionnaire was self-administered after instruction by a bilingual Polish American public health graduate student. Each questionnaire took approximately 45-60 minutes to complete. and was completed either at home or at the social organization. There were 900 questionnaires distributed to participants, and 461 that were returned. Of these, 396 were sufficiently complete, and were included in the analysis. Questionnaires were reviewed and edited prior to data entry into DIETSYS, with telephone follow up as needed to clarify incomplete questionnaires. All questionnaires were manually edited to code data numerically, and after DIETSYS analysis, nutrient and food component intake data were then entered into SAS (release 8.01 for Windows, 2000, SAS Institute, Cary, NC) for statistical analysis.

Respondents were categorized according to their country of birth and level of education to create two exposure variables. Country of birth was dichotomized into those born in the United States and those born in Poland, and education initially was dichotomized into those with a high school education or less and those who had at least some college education. Education was then further stratified into quartiles in which education was categorized as less than graduation from high school, high school graduate, some college education and college graduate.

Nutrients and food components (e.g., dietary fiber, carotenoids) were expressed using the density method as daily values per 1,000 kcal, and as a percentage of energy intake for fat, carbohydrates, protein, and sweets. In addition, daily frequencies of various food group intakes were calculated. In the case of nutrients and food components expressed using the density method; this 'multivariate nutrient density model' retains the familiar nutrient density and addresses the potential problem of confounding by total energy intake by adding it as another variable (Willett et al., 1997). Means of the continuous nutrient intakes were computed within country of birth, without adjusting for potential confounders, and for each of the education categories adjusting for age and total calories per day. Natural log-transformation was used because many of the observed nutrient distributions did not follow a normal Gaussian distribution (Cole, 1997). Multiple linear regression models were calculated using PROC REG procedure of SAS and examined the association of country of birth and education level with natural log-transformed nutrient intakes, adjusting for daily energy intake and age.

RESULTS

There were a total of 396 women who participated in our study, of whom 139 were US born and 257 were born in Poland (Table 1). The Polish born women were more likely to speak Polish at home and were more likely to have graduated from college, while the US born women were more likely to be high school graduates. The US born women had higher BMIs (26.5 versus 25.1) while the Polish born women had higher daily energy intake (1613 versus 1538 kcal/day) (Table 1).

For women who had a high school education or less there were statistically significant differences in dietary intake between Polish and US born women for protein, linoleic acid, vitamin A, thiamin, riboflavin, folate, vitamin B6, vitamin C, calcium, phosphorus, potassium, zinc, dietary fiber, lutein, lycopene, alpha and beta carotene, pro-A carotene, retinol, breads and cereals, fruit, dairy foods, vegetables, cured or smoked meats frequency, and percentage calories from protein and sweets (Table 2). For women who had at least some college education there were statistically significant dietary differences only for vitamin A, vitamin C, riboflavin, niacin, calcium, phosphorus, potassium, lycopene, retinol, and frequency of fruits, dairy foods, cured or smoked meats, and percent of calories from sweets. When education level by country of birth was stratified by less than high school graduate, high school graduate, some college education, and college graduate, we found statistically significant dietary differences between US born versus Polish born women with less than high school graduation for vitamin A, vitamin C, thiamin, riboflavin, folate, calcium, phosphorus, magnesium, potassium, lutein, lycopene, retinol, frequency of dairy foods and percentage of calories from sweets. For high school graduates we found statistically significant dietary differences for linoleic acid, protein, vitamin A, vitamin C, thiamin, riboflavin, vitamin B6, phosphorus, potassium, dietary fiber, alpha carotene, pro-A carotene, retinol, cryptoxanthin, lutein, lycopene, frequency of breads and cereals, fruits, protein foods, dairy foods, vegetables, smoked meat, and percentage of calories from protein and sweets. For women with some college education we found statistically significant dietary differences for linoleic acid, vitamin A, niacin, lycopene, retinol, frequency of fruits, and percentage of calories from sweets. For women who were college graduates there were only statistically significant dietary differences for thiamin, vitamin C, lycopene, retinol, and frequency of fruits.

Table 1: Descriptive Characteristics of Participants by Country of Birth

	Total *n=396*	*US-born* *n=139*	*Polish-born* *n=257*	*p-value*
Age (mean ± SD)	45.3 ± 14.3	49.1 ± 16.5	43.2 ± 12.4	0.0003
Language Spoken at Home (%)				
No English	26.4	1.4	40.0	<0.0001
Some English	23.6	3.6	34.5	
Equal English and Polish	10.9	3.6	14.9	
Mostly English	12.4	21.6	7.5	
Only English	26.7	69.8	3.1	
Education (%)				
Less than high school graduate	13.6	8.6	16.3	0.2999
High school graduate	32.8	43.9	26.9	
Some college	27.3	27.3	27.2	
College graduate	26.3	20.1	29.6	
Number of years in US (mean ± SD)			15.5 ± 12.6	
Age at migration (mean ± SD)			27.7 ± 12.3	
Polish Parents (%)				
None	1.5	0	2.3	<0.0001
One	11.7	28.3	2.7	
Both	86.8	71.7	94.9	
Body Mass Index (mean ± SD)	25.6 ± 5.0	26.5 ± 4.4	25.1 ± 5.2	0.0053
Energy Intake (mean ± SD)	1587 ± 613	1538 ± 614	1613 ± 612	0.248

Table 2: Mean Dietary Intakes (nutrient/1000kcal) by country of birth stratified by dichotomous education variables

	High School Graduate or Less			*Some College +*		
Nutrients per 1000 Kcal	*US n=73*	*Poland n=111*	*p-value*	*US n=66*	*Poland n=146*	*p-value*
Carbohydrates (g)	118	116	.88	120	119	.66
Total Fat (g)	40	40	.73	38	39	.36
Saturated Fat (g)	14	15	.59	13	14	.63
Oleic Acid (g)	15	15	.21	14	14	.96
Linoleic Acid (g)	7	6	.004	7	6	.09
Protein (g)	42	45	.001	43	44	.73
Vitamin A (IU)	3692	4175	.0003	4096	4546	.16
Vitamin A (RE)	611	732	<.0001	624	776	.0037
Vitamin E (á-TE)	5.0	5.0	.71	5.7	5.4	.82
Thiamin (mg)	0.8	0.9	<.0001	0.9	0.9	.14
Riboflavin (mg)	1.1	1.3	.0002	1.1	1.2	.02
Niacin (mg)	10	10	.712	12	11	.01
Folate (mcg)	138	146	.0037	161	156	.98
Vitamin B6 (mg)	0.9	0.9	.0077	1.0	1.0	.08
Vitamin C (mg)	52	60	.0022	58	65	.04
Calcium (mg)	484	548	.0041	447	526	.04
Phosphorus (mg)	682	745	<.0001	678	7369	.04
Sodium (mg)	1694	2002	<.0001	1827	1953	.02
Magnesium (mg)	251	225	.18	234	237	.76
Potassium (mg)	1498	1573	.0005	1497	1618	.02
Iron (mg)	6.6	6.5	.30	7.4	7.1	.21
Zinc (mg)	5.8	5.9	.09	6.3	5.9	.18
Zinc from Animal (mg)	3.7	3.8	.31	3.5	3.5	.36
Percent Kcal from Carbohydrates	47	46	.89	48	470	.67
Percent Kcal from Sweets	15.6	10.7	<.0001	11.7	9.9	.014
Percent Kcal from Fat	36.0	36.2	.73	34.2	35.2	.36
Percent Kcal from Protein	17	18	.001	17	18	.74
Food Components and Antioxidants						
C holesterol (mg)	134	148	.18	134	147	.20
Dietary Fiber (g)	6.6	7.1	.0009	7.6	8.3	.08
Alpha Carotene (mcg)	164	205	.0007	213	240	.24
Beta Carotene (mcg)	1283	1333	.05	1580	1498	.81
Pro-A Carotene (mcg)	1544	1631	.03	1882	1849	.91
Retinol (mcg)	387	508	<.0001	345	514	<.0001
Cryptoxanthin (mcg)	39	45	.08	40	49	.13
Lutein (mcg)	500	614	.0006	863	759	.65
Lycopene (mcg)	593	350	<.0001	808	557	<.0001
Food Group Frequency Calculations (servings/day)						
Breads and Cereals	2.4	2.8	.01	2.9	2.8	.51
Protein Foods	1.8	2.2	.19	1.9	1.9	.88
Cured or Smoked Meat/Fish	0.4	0.8	.0003	0.4	0.5	.05
Dairy Foods	2.7	3.8	<.0001	2.2	3.2	.02
Fruits and Fruit Juices	1.1	1.8	<.0001	1.4	2.0	<.0001
Vegetables	1.8	2.2	.0002	2.2	2.3	.11
Fats/Oils, Sweets, and Snacks	4.4	4.7	.32	3.6	3.8	.90

While these statistically significant nutrient intake differences are interesting, some of these may not have any nutritional significance, and some are for nutrients not usually associated with either cardiovascular disease or cancer. In addition, caution is needed in interpreting these differences because the range of standard deviations is often relatively large. Some of these differences are intriguing, for example those of thiamin, riboflavin and niacin, and need further exploration.

Other interesting findings include the generally low intakes of nutrients and food components such as linoleic acid, vitamin A (retinol equivalents), vitamin C, folate, calcium, potassium, zinc, and dietary fiber; recommended and/or average US intakes of these nutrients and food components are often two to three times those reported in this study. Percent of energy intake was higher than the recommended 30 percent of kilocalories. For some nutrients (e.g., calcium, vitamin A,) Polish born women had intakes closer to the recommendations than did women born in the US; this was particularly noted within the lower educated strata. However, there seems to be some evidence of dietary acculturation with the higher levels of lycopene in the US born women, most likely reflecting their higher intake of foods with tomatoes, such as pizza and spaghetti sauce.

DISCUSSION

It has already been shown in this immigrant population that there are differences in dietary intake both by country of birth but also by dietary acculturation over time (Dunham et al., 2004). Dietary acculturation has also previously been demonstrated among Chinese as they immigrate to the United States and other countries (Du et al., 2002; Satia-Abouta et al., 2002). Over 20% of breast cancer risk can be attributed to dietary factors (Mezzetti et al., 1998), and recent studies have demonstrated that intakes of fruits, vegetables and vitamin A have been associated with a decreased risk of breast cancer, while higher intake of cakes, desserts, and refined sugars appears to increase breast cancer risk (Franceschi et al., 1997; Longnecker et al., 1997). In our study, we found that the greatest differences in dietary intake are found among less educated women. This has also been demonstrated in Chinese who immigrate to the North America (Aatia-Abouta et al., 2002). We found a higher incidence of linoleic acid intake among US born women without any college education. When this was stratified into education quartiles, statistically significant differences were found among the middle quartiles. Linoleic acid intakes among the least educated did not reach statistical significance, but the small numbers in this group did not have sufficient power to reach significance. This is consistent with previous studies which suggest that linoleic acid may be a factor in the etiology of breast cancer (Aro et al., 2000; Prentice et al., 1988). It has previously been shown among this ethnic group that for women born in Poland there is a higher intake of vitamins A and C, and beta carotene as well as increased frequency of fruit and vegetable consumption compared to US born women (Dunham et al., 2004). Also, there was a trend for higher intake for some of these among the more recent immigrants, which is also consistent with previous data suggesting these foods are protective against breast cancer (Dunham et al., 2004; Howe et al., 1992). We found that among women without any college education there are differences for consumption of vitamins A and C, alpha and beta carotene as well as frequency of fruits and vegetables. For women with some college education there is only statistically significant higher dietary intake among Polish born women for some but not all forms of vitamin A, vitamin C, and frequency of fruits. When stratified into education quartiles, the second least educated quartile had more statistically significant differences for vitamins A and, C, alpha and beta carotene, and fruit and vegetable frequency compared to the higher educated groups. The least educated quartile did not have as many statistically significant differences as the quartile that completed only high school, but this again may be due to small numbers and limited power associated with the group who did not graduate from high school. A similar trend regarding increased fruit and vegetable consumption for less educated Chinese immigrants compared to better educated Chinese immigrants has also been observed (Aatia-Abouta et al., 2002). Folate intake also has been suggested as protective against breast cancer (Shrubsole et al., 2001), and folate intake has previously been shown to be higher among the Polish born women (Dunham et al., 2004). We found significant differences for folate intake among the least educated quartile and for the less educated dichotomous group using the dichotomous variable, but not the 3 higher educated quartiles or dichotomous variable. These findings need to be interpreted remembering that reported folate intakes for all groups were below the recommendation.

Previously it has been shown that Polish born women and more recent immigrants among the Polish born women (who have a higher risk of gastric cancer than US born women) had higher frequency of cured or smoked meat intake (Dunham et al., 2004), foods reported to be associated with gastric cancer (Boeing et al., 1991; Hensrud and Heimburger, 1998). Both the dichotomous education variables had differences among the frequency of cured or smoked meat between the US or Polish born women, but when stratified into education quartiles, there is only statistical significance for women who are high school graduates. Previously, it has been shown there is an increase in reported protein intake and percent of energy as protein among the Polish born immigrants, and this is consistent with recent studies implicating high protein diets as a cause of stomach cancer (Chen et al., 2002).

The results of our study give conflicting results with regards to nutrients associated with coronary artery disease. Saturated fat intake was not found to differ by education level . Folate, which is often found to be consumed in greater quantities in lower risk

Table 3: Mean Dietary Intakes (nutrient/1000kcal) by country of birth stratified by education quartiles

Nutrients per 1000 Kcal	Less than HS Graduate			HS Graduate			Some College			College Graduate		
	US n=112	Poland n=42	p-value	US n=61	Poland n=69	p-value	US n=38	Poland n=70	p-value	US n=28	Poland n=76	p-value
Carbohydrates (g)	111	113	.57	119	117	.98	118	118	.94	122	119	.32
Total Fat (g)	44	42	.28	39	39	.59	39	39	.95	37	39	.09
Saturated Fat (g)	16	15	.35	13	14	.860	13	14	.73	13	14	.17
Oleic Acid (g)	16	15	.22	15	14	.18	14	14	.66	14	14	.38
Linoleic Acid (g)	7	7	.47	7	6	.0033	7	6	.02	7	6	.82
Protein (g)	42	43	.22	42	45	.0014	44	45	.39	43	43	.74
Vitamin A (IU)	3633	4785	.04	3703	3804	.008	3699	4946	.03	4635	4179	.66
Vitamin A (RE)	614	824	.007	610	675	.0034	582	822	.0013	681	733	.56
Vitamin E (á-TE)	4.0	5.8	.11	5.2	4.5	.29	6.0	4.9	.08	5.3	5.8	.17
Thiamin (mg)	0.7	0.9	.04	0.8	0.9	.0001	0.9	0.9	.82	0.8	0.9	.03
Riboflavin (mg)	1.1	1.3	.0028	1.2	1.2	.02	1.2	1.2	.21	1.1	1.2	.07
Niacin (mg)	10	11	.95	11	10	.62	12	10	.02	12	11	.20
Folate (mcg)	109	161	.0069	144	138	.07	166	145	.21	155	167	.26
Vitamin B6 (mg)	0.9	1.0	.33	0.9	0.9	.0081	1.0	0.9	.29	0.9	1.0	.50
Vitamin C (mg)	41	58	.05	54	61	.0043	62	58	.76	52	71	.02
Calcium (mg)	425	567	.0043	495	536	.06	451	531	.14	443	521	.30
Phosphorus (mg)	636	748	.0013	691	743	.0022	680	750	.06	676	724	.39
Magnesium (mg)	139	220	.0006	273	227	.48	247	245	.83	218	230	.60
Sodium (mg)	1765	2010	.11	1680	1998	.0001	1792	1989	.0036	1874	1921	.44
Potassium (mg)	1449	1551	.04	1508	1587	.0009	1507	1610	.08	1483	1627	.27
Iron (mg)	6.5	6.5	.90	6.6	6.5	.11	7.4	6.9	.19	7.4	7.2	.77
Zinc (mg)	5.3	6.2	.25	5.9	5.8	.19	6.5	5.8	.06	5.9	5.9	.86
Zinc from Animal (mg)	3.7	3.6	.72	3.7	3.9	.13	3.7	3.6	.50	3.3	3.3	.64
Percent Kcal from Carbohydrate	44.4	45.3	.56	47.7	46.9	.97	47.4	47.2	.94	49.0	47.7	.32
Percent Kcal from Sweets	14.4	10.7	.0054	15.8	10.7	.0007	11.6	10.5	.0096	11.8	9.3	.45
Percent Kcal from Fat	39.3	37.7	.28	35.3	35.3	.59	34.9	35.1	.95	33.2	35.3	.09
Percent Kcal from Protein	17	17	.21	17	18	.0014	17	18	.40	17	17	.74
Food Components and Antioxidants												
Cholesterol (mg)	151	149	.38	131	148	.11	137	151	.21	130	145	.30
Dietary Fiber (g)	7.0	6.9	.40	6.5	7.3	.0001	7.3	8.0	.20	8.0	8.6	.34
Alpha Carotene (mcg)	106	217	.63	176	197	.0002	185	268	.16	251	213	.82
Beta Carotene (mcg)	1265	1613	.20	1287	1162	.12	1380	1723	.54	1851	1290	.21
Pro-A Carotene (mcg)	1473	1909	.29	1558	1461	.05	1650	2059	.44	2195	1655	.37
Retinol (mcg)	395	561	.01	386	476	.01	344	527	.0013	347	502	.01
Cryptoxanthin (mcg)	38	42	.76	39	46	.03	44	43	.90	34	55	.09
Lutein (mcg)	349	692	.01	530	566	.004	901	794	.79	811	726	.66
Lycopene (mcg)	440	360	.01	623	344	<.0001	725	592	.0004	921	524	<.0001
Food Group Frequency Calculations (servings/day)												
Breads and Cereals	2.5	2.7	.20	2.3	2.9	.02	2.7	2.8	.57	3.3	2.8	.06
Protein Foods	2.4	2.1	.23	1.7	2.3	.03	1.8	2.2	.35	2.0	1.7	.92
Cured or Smoked Meat/Fish	0.7	0.8	.65	0.4	0.7	.0006	0.3	0.6	.11	0.4	0.5	.14
Dairy Foods	3.3	4.1	.03	2.6	3.6	.0024	2.0	3.2	.16	2.4	3.2	.22
Fruits and Fruit Juices	1.2	1.6	.22	1.0	1.9	<.0001	1.3	1.9	.02	1.4	2.0	.0007
Vegetables	2.1	2.3	.24	1.7	2.2	.0011	2.1	2.3	.31	2.5	2.2	.16
Fats/Oils, Sweets, and Snacks	5.2	4.8	.28	4.3	4.6	.39	3.5	4.0	.43	3.7	3.7	.28

populations, was previously found to be consumed in larger amounts among Polish born women (Dunham et al., 2004; Gerhard et al., 1999). Folate intake was higher in the less educated groups as mentioned earlier, although levels were lower than recommended.

Findings from this study are useful for epidemiologists and health care providers, although some limitations to the data must also be considered. The dietary intake data are self-reported, and there is some loss of accuracy or precision with the portion size categories in semi-quantitative food frequencies (Sempos, 1992). Food frequencies may overestimate actual intake, perhaps magnifying differences in both dietary protective factors and risks; thus findings from this (and any other study of dietary estimates based on a food frequency) study need to be conservatively considered. Another study limitation is that there was no corresponding validation study. Without additional dietary and medical history information, interpretation of these subtle trends in dietary intake with education must be tempered with their potential clinical impact on disease risk. An additional concern is the low response rate (396/900=44%), and some of the subgroup analysis cells are relatively small. This brings up the question as to whether our results are generalizable to the population at large.

Results from this study show a mixed effect of education on the dietary patterns of these Polish and Polish ancestry women. Studies of dietary change, education and migration can provide useful clues for diet and chronic disease risk research in U.S. populations, often pointing the way to dietary interventions which may reduce risk. While results from this study may not be generalizable to the dietary changes of all Polish women immigrating to the US and acculturating to new dietary patterns, they do provide insights suggesting dietary recommendations for these women to reduce their risks of breast and gastric cancers and cardiovascular disease by consuming more fruits, vegetables, low fat dairy products, whole grains, and legumes, lean meats, poultry, and fish while limiting their intakes of salted and cured meats, sweets and desserts.

Our study indicated that dietary differences occur among women belonging to the same ethnic group, depending on the country of their birth, and among immigrants, depending upon their education level. The findings highlight high risk diets which may be amenable to intervention among immigrant Polish women. In particular, women who have emigrated from a country with a diet at low risk for breast cancer and coronary artery disease should be encouraged to maintain the positive aspects of their diet and resist dietary acculturation when it is detrimental in terms of chronic disease risk. Educational efforts involving alterations in diet should be encouraged to more highly educated groups as well as the US born people of Polish descent. In Chicago, there are easy ways to differentiate between these groups such as geographic patterns (higher educated patients tend to reside in different areas), and linguistic differences (Polish born women are more likely to speak Polish than English). Using these differences, educational initiatives can be tailored to those whom we wish to preserve their diet versus those we wish to change.

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ABSTRACT Changes in breast cancer, gastric cancer and coronary arterial disease among people of Polish descent after migration to the United States suggest there may be potentially modifiable factors affecting incidence of these diseases. The objective of this analysis was to examine the role of education on dietary intake in Polish-born and U.S.-born women of Polish descent. Women of Polish descent (n=396), ages 17-81 were selected from Polish women's social organizations. Women completed a modified Health Habits and History Questionnaire. Participants were stratified for the analysis by country of birth and level of education. The average daily intake of nutrients, food components and food groups, was assessed using multiple linear regression. These were compared for women by country of birth and level of education. The greatest number of statistically significant differences in nutrient and food group intakes by birthplace was between the two groups of Polish descent women with lower education. Fewer differences were noted in women with college education. Less educated women born in Poland tended to higher intakes of nutrients considered protective against chronic diseases, indicating perhaps a protective effect of their lower acculturation on dietary intake. In conclusion, it can be stated that less educated women from Poland were less likely to have dietary acculturation after migration to the United States. There are significant dietary differences among women of Polish descent that vary by education and birthplace. Women with diets placing them at higher risk for cancers and cardiovascular disease should be targeted for interventions to lower their risk.

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