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Comparison of Baseline Dietary Intake of Hispanic and Matched Non-Hispanic White Breast Cancer Survivors Enrolled in the Women's Healthy Eating and Living Study

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Abstract

Objective—To assess the reported baseline dietary intake of Hispanic and non-Hispanic white breast cancer survivors in the Women's Healthy Eating and Living study, a randomized plant-based dietary intervention clinical trial.

Design—Dietary data from 4 days repeated 24-hour recalls within 3 weeks included daily total intake of energy, protein, carbohydrates, cholesterol, total fat, monounsaturated fat, saturated fat, polyunsaturated fat, fruit/vegetable servings, carotenoids, alcohol, caffeine, and percentage of energy from protein, carbohydrates, alcohol, and fats.

Subjects—One hundred sixty-five Hispanic breast cancer survivors age-matched to 165 non-Hispanic white breast cancer survivors diagnosed with Stage I, II, or IIIA primary operable breast cancer.

Statistical analyses—Two-sample *t* tests and Wilcoxon rank sum tests to compare dietary intake, and logistic and ordinal logistic regression analyses to examine the association between ethnicity, alcohol, and lycopene consumption, while controlling for place of birth, education, body mass index, and time since diagnosis.

Results—Hispanics were more likely to be foreign-born ($P<0.001$), less educated ($P<0.0001$) and to consume higher amounts of lycopene ($P=0.029$), while non-Hispanic whites were more likely to consume alcohol ($P=0.001$). However, no differences were observed in the average amounts of alcohol consumed or total percents of energy from alcohol. Both groups consumed more than five servings of fruits and vegetables daily. Being Hispanic remained a significant predictor of lower alcohol use ($P=0.004$) and higher lycopene consumption ($P=0.005$) after controlling for place of birth, education, body mass index, and time since diagnosis.

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Conclusions—There are more similarities than differences in the dietary intake of Hispanic and non-Hispanic white breast cancer survivors in the Women's Healthy Eating and Living study. Further analysis is needed to determine if higher lycopene consumption shown among the Hispanic participants will translate to greater protection against breast cancer recurrence or increased survival.

In the United States the risk of developing breast cancer differs significantly among women of different ethnicities or racial groups. The risk is highest for non-Hispanic white women, followed in decreasing frequency by African Americans, Asians, Pacific Islanders, Hispanics, American Indians, and Alaskan Natives (1,2). These differences may potentially be explained by culture and environmental factors, such as diet (3-13).

Dietary studies have suggested that diets high in fruits and vegetables and low in alcohol and total and saturated fats may reduce the risk of breast cancer (4-8,11) and breast cancer recurrence (14-16). Among women with a high incidence of familial breast cancer, an inverse association between carotenoid-rich foods and breast cancer has been reported (6), and alcohol consumption has been associated with an increased risk of breast cancer (16,17), particularly among women with folate insufficient diets. One study designed to evaluate variations in nutrient intake among breast cancer patients demonstrated statistically significant ethnic variation in dietary intake between African-American, Chinese, Hispanic, Japanese and non-Hispanic white breast cancer female patients (18).

To develop effective dietary intervention strategies for breast cancer survivors from different ethnicities or racial backgrounds, researchers must be familiar with the dietary patterns of the population they are targeting. Further, identifying significant differences in dietary patterns across ethnic groups may help to explain ethnic differences in breast cancer and breast cancer recurrence rates. To this end, before the study intervention, we evaluated the baseline reported dietary intake of the Hispanic breast cancer survivors and a subset of non-Hispanic white breast cancer survivors enrolled in a randomized controlled dietary intervention study.

METHODS

Study Population

This study represents a subgroup analysis of data collected from breast cancer survivors participating in the Women's Healthy Eating and Living (WHEL) study, a multicenter randomized controlled clinical trial of 3,088 women previously treated for breast cancer designed to determine if a diet high in fiber, fruit, and vegetables, and low in fat increases breast cancer survival (19). The data presented in this article include all Hispanic participants enrolled in the WHEL study at baseline (N=165). Hispanic ethnicity was self-reported and included participants born in the United States, Mexico, the Caribbean, Central America, Europe, South America, and Asia. Hispanic participants interested in participating in the WHEL study were required to be able to speak, write, and read the English language. For this analysis, the Hispanic participants were randomly matched (1:1 ratio) to a subset of WHEL study participants on age at the time of study enrollment using a range of ±5 years. Our rationale for not including all the non-Hispanic white participants was twofold: the WHEL study was not balanced by ethnicity, and the total number of non-Hispanic white participants far exceeded the total number of Hispanic participants.

The WHEL study was approved by the institutional review boards of the seven participating centers (University of California at San Diego and Davis; Kaiser Permanente Northern California, Oakland, CA; The University of Texas M. D. Anderson Cancer Center, Houston, TX; Stanford Prevention Research Center, Stanford, CA; University of Arizona, Tucson, AZ; and Center for Health Research, Portland, OR). Further description of the study design and methodology of the WHEL study has been published elsewhere (20-25).

Dietary Intake Data

Dietary intake data were collected using four 24-hour recalls collected within a 3-week period on randomly selected days that were stratified for weekend vs weekdays (24). Recalls were conducted by telephone by trained dietary assessors located at the University of California, San Diego, using the US Department of Agriculture Multi-pass recall method (26). Quality control for the 24-hour recalls was conducted (24,25). Participants were educated on how to complete recalls during the baseline clinic visit and were provided written guidelines and pictures of portion estimates to assist during the recall process (20,25). All telephone interviews were conducted in English. Dietary assessors were not involved in the administration of dietary interventions and this analysis included only baseline dietary recalls which were conducted before randomization. Dietary data collected during the recall were entered into the Nutrition Data System (version 4.0, 2000, University of Minnesota Nutrition Coordinating Center, Minneapolis, MN) computer-based software for nutrient analysis. Nutrition Data System data were used to assess intake of the following: daily total energy (kilocalories/day); fiber intake (grams/day); cholesterol (grams/day); protein (grams/day); total fat (grams/day); monounsaturated fat (grams/day); saturated fat (grams/day); polyun-saturated fat (grams/day); alcohol (grams/day); caffeine (grams/day); percent energy from all types of fats, protein, carbohydrates, and alcohol; and reported carotenoid intake. The average daily number of servings of fruits and vegetables (1 serving=½ c), which also included mixed dishes such as tacos, burritos, soups, sandwiches, and stews, were calculated using software developed by the University of California at San Diego Cancer Prevention and Control Program, La Jolla, CA (23). Estimates of dietary carotenoid intake were obtained from the Nutrition Data System nutrient analysis, which includes food analytical estimates from the US Department of Agriculture carotenoid database (27).

Sociodemographic data for the WHEL study were collected by telephone during the screening interview (20), and included date of birth, age, self-reported ethnicity (eg, African American, Asian, Hispanic, or white), date of breast cancer diagnosis and stage at diagnosis confirmed through medical records review, education level, marital status, and occupation. Place of birth was also self-reported and collected via a written questionnaire, and height and weight were measured during the first clinic visit by standard procedures to calculate body mass index (BMI).

Statistical Analyses

All analyses were performed with the Statistical Analysis System (version 8.2, 2001, SAS Institute, Cary, NC). Two-sample *t* tests and χ^2 tests were used to compare the sociodemographic and clinical characteristics of the study population by ethnicity. Wilcoxon rank sum test was used to compare the dietary intake of study participants because the nutrition variables tended to be non-normally distributed. Univariate logistic regression models were fit to examine the independent association between ethnicity, place of birth, education, BMI, time since diagnosis, and the nutrition variables. In addition, multivariate logistic models were conducted to examine the association between ethnicity and those nutrition variables that were found to be statistically significantly different between the ethnic groups, while controlling for place of birth, education, BMI, and time since diagnosis. Finally, ordinal logistic regression models were used to examine the association between ethnicity and the nutrition variables that had a large number of participants who reported “no intake.” Each nutrient was categorized into quartiles, and tested for the proportional odds assumption.

RESULTS

A comparison of the sociodemographic and clinical characteristics of study participants by ethnic group shows the groups had similar marital status, BMI, menopausal status, and breast

cancer stage at diagnosis (Table 1). Due to matching, the mean age at enrollment for both Hispanic and non-Hispanic white participants was identical (50.6 years). The mean time since breast cancer diagnosis and enrollment into the WHEL study was 2 years for both ethnic groups. One third of Hispanic participants were born outside the United States vs 10% of non-Hispanic white participants ($P<0.001$). A higher percentage of the non-Hispanic white women were college or university graduates (53%) compared to only one third of the Hispanics ($P<0.0001$).

Table 2 compares, by ethnic group, the baseline reported daily mean dietary intake of selected nutrients among study participants. Overall, the diets of the two groups were similar, with the exception of the proportion of women who reported any alcohol use during the 4 days of intake recalled and the average daily consumption of lycopene. A higher percentage of non-Hispanic white participants reported using alcohol than Hispanic participants (75.8% vs 59.4%; $P=0.001$); however, among those reporting any alcohol intake, there was no statistically significant difference in the amount of alcohol consumed or in the percent energy from alcohol consumed (Table 2). Hispanic participants had higher mean intakes of lycopene than non-Hispanic white participants ($P=0.029$). In regard to fruit and vegetable consumption, both ethnic groups reported consuming, on average, more than five servings of fruits and vegetables daily (5.4 and 5.9 servings for Hispanics and non-Hispanic whites, respectively).

Since the percentage of non-Hispanic whites who reported any alcohol consumption during the 4 days recalled was significantly higher than the percentage of Hispanic women reporting any alcohol consumption, we fit logistic regression models (Table 3) to determine whether ethnicity was associated with any alcohol use. Both the univariate and multivariate analyses showed a significant association between ethnicity and alcohol use. In the univariate analysis, Hispanic participants were 53% less likely to use alcohol compared to non-Hispanic white participants (odds ratio [OR] 0.47, 95% confidence interval [CI] [0.29, 0.75]), even after controlling for place of birth, education, BMI, and time since diagnosis (OR=0.44, 95% CI [0.26, 0.74]). The educational status of study participants was also associated with alcohol use. Participants with a posthigh school/some college education were almost three times more likely to use alcohol than participants with only a high school education, in both the univariate (OR 2.98, 95% CI [1.60, 5.55]) and multivariate analyses (OR 2.67, 95% CI [1.40, 5.05]). To a lesser extent, the same association was observed among participants who were college/university graduates.

Because lycopene consumption was found to be significantly different between the two ethnicities (Table 2), an ordinal logistic regression model (Table 4) was used to measure the association between ethnicity and lycopene consumption. Because the lycopene data were highly skewed, quartiles of mean daily intake were used to convert it into proportionally equal categories: <1,203 μg, 1,203 μg to 2,564.4 μg, 2,564.5 μg to 4393.7 μg, and >4393.7 μg. Results of the univariate ordinal logistic regression analysis showed that ethnicity was significantly associated with lycopene consumption, with Hispanic women being 52% more likely to consume foods with higher amounts of lycopene than their non-Hispanic white counterparts (OR 1.52, 95% CI [1.03, 2.42]). Even after controlling for place of birth, education, BMI, and time since diagnosis (Table 3), Hispanic participants remained more likely (56%) to consume significantly greater amounts of lycopene daily than non-Hispanic white participants (Table 4). In addition to ethnicity, the BMI status of study participants was also associated with lycopene consumption. Overweight participants were 70% more likely to consume lycopene than participants of normal weight, in both the univariate (OR 1.70, 95% CI [1.06, 2.72]) and multivariate analyses (OR 1.70, 95% CI [1.05, 2.73]).

DISCUSSION

We compared baseline reported dietary intakes of Hispanic and non-Hispanic white women enrolled in a plant-based dietary intervention trial, on average, 2 years after their breast cancer diagnosis. Overall, the two ethnic groups were sociodemographically and clinically similar, with the exception of their place of birth and educational status, with more Hispanic participants being born outside of the United States, and non-Hispanic white participants having a higher education level. The latter finding supports the findings of the US Census Bureau, which shows the education level of Hispanics in the United States are lower than those of other ethnic groups (28). Nevertheless, the educational status of the Hispanic participants in this study was found to be higher than the educational level of Hispanics reported in other cancer studies (29-31). This may reflect the overall greater socioeconomic status of WHEL participants, who tend to be middle-class or upper-class as defined by their educational status. Further, as we excluded women who reported Spanish-only literacy and language, we may have selected for a more acculturated subgroup of Hispanic breast cancer survivors resulting in greater similarity in sociodemographic variables than would be expected.

The dietary intakes of both ethnic groups were similar, with the exception of the percentage who consumed alcohol during the 4 days recalled. The mean alcohol intakes for both groups were below the national average (32). The study findings suggesting very low alcohol consumption are consistent with a report from Hernández-Valero and colleagues (33) of 3,384 Hispanic women of Mexican origin, which found that <20% of the population reported ever consuming alcoholic beverages. The alcohol–breast cancer association also previously has been investigated by Baumgartner and colleagues (34) in a biethnic study between non-Hispanic white and Hispanic breast cancer survivors. In that study alcohol intake did not appear to have a consistent or significant association with breast cancer risk in Hispanic women (33). Whether the lower quantity of alcohol intake will be associated with a significant reduction in breast cancer recurrence risk for the Hispanic participants in this study remains to be evaluated.

In our analysis, both ethnic groups reported similar mean daily consumption of fruits and vegetables, which was also supported by similar carotenoid intake, with the exception of lycopene for which Hispanics reported greater intake than non-Hispanic whites. Because the study population had been diagnosed with breast cancer 2 years before their enrollment into the WHEL study, there is the possibility that fruit and vegetable intake increased in response to the breast cancer diagnosis, as has been previously reported for the total WHEL study population (21). Alternatively, these levels of fruit and vegetable intake may be more representative of breast cancer survivors volunteering for a dietary intervention trial, and not representative of breast cancer survivors as a whole, as previously shown in nonintervention dietary studies (35,36). Further, the significant difference in lycopene intake may reflect the daily use of tomato products (eg, sauce and paste) in many Hispanic dishes such as salsas (tomato-based sauces), and *sofritos* (a combination of sautéed onions, garlic, bell peppers, and tomato sauce and oil), which are an integral part of the daily cuisine among certain Hispanic groups (37-39).

Only a few studies have examined the relationship between breast cancer and tomato products (6,40,41) or serum or plasma lycopene levels (42-46). Dietary-based studies (6,44,45) generally have not found an association between breast cancer risk and tomato intake. However, other studies that have investigated the risk of breast cancer in relation to plasma or serum lycopene levels (42-49) have observed a significant gradient of decreasing risk with increasing lycopene concentration. Further, mechanistic evidence also exists to support a protective role for lycopene in breast cancer. For example, Levy and colleagues (47) found lycopene to have antiproliferative effects against breast cancer cells in culture and Sharoni and

colleagues (48) have shown that rats treated with tomato oleoresin developed fewer 7,12-dimethylbenz(a)anthracene-induced mammary tumors. In addition to lycopene, tomatoes have other potential health-enhancing compounds like ascorbic acid (vitamin C), and hypothetically the complex interactions of these compounds may also contribute to the anticancer properties of tomato products (49). A study conducted by Porrini and colleagues (50) among healthy individuals found that the daily intake of a formulated tomato drink significantly reduced (by about 42%) DNA damage in lymphocytes, suggesting that oxidative stress may be favorably modulated with tomato foods thus indirectly reducing cancer risk.

The relationship between lycopene, tomatoes, and breast cancer risk remains unclear and more evidence is needed. Furthermore, recent findings suggest that currently there is little evidence from epidemiologic studies to support a protective relationship between fruits and vegetable intake and breast cancer, although ethnic-specific associations have not been fully explored (6-9,11,49,50). One reason for the inconsistent findings maybe dose; another maybe the nutrient and/or phytochemical density of the specific plant foods consumed by the study populations. Thus, it is not inconceivable that the higher tomato intake among Hispanics may play a role in breast cancer risk reduction, including reduction in risk for breast cancer recurrence, and contribute to lower rates of breast cancer in this population. However, much more research is needed before any clinical recommendations can be made (14,15).

Caution must be taken in generalizing the findings of this study to all Hispanic and non-Hispanic white women in the United States because of possible bias due to differences in the sociodemographic and educational status between the ethnic groups, and the small number of Hispanic women enrolled in the WHEL study, which did not allow for stratification by place of birth.

CONCLUSIONS

Our research shows that overall there are more similarities than differences in the reported dietary intake of Hispanic and non-Hispanic white breast cancer survivors after diagnosis. However, a few interesting differences (ie, alcohol use and lycopene consumption) were observed that may influence the main study measured outcomes. Further analysis is needed to determine if higher lycopene consumption provides protection against breast cancer recurrence or increased survival in this group of women. In addition, similar studies need to be conducted with greater numbers of breast cancer survivors from this ethnic group, including non-English speaking Hispanics and/or those reporting lower acculturation levels.

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>Table 1

Sociodemographic and clinical characteristics of Hispanic and matched non-Hispanic white breast cancer survivors enrolled in the Women's Healthy Eating and Living Study (N=330)[a]

Characteristic	Hispanic (n=165)	Non-Hispanic white (n= 165)	*P* value
	← mean± standard deviation →		
Age at enrollment (y)	50.6±9.3	50.6± 9.3	1.000
Age at diagnosis (y)	48.8±9.2	48.8± 9.3	0.999
Body mass index	28.1 ±6.3	27.9± 7.0	0.843
	← n (%) →		
Place of birth			
United States	111 (67.3)	148 (89.7)	
Outside the United States[b]	54 (32.7)	17(10.3)	<0.001
Education			
High School	52 (31.5)	25 (15.2)	
Posthigh school/some college	62 (37.6)	52 (31.5)	
Postcollege/university graduate	51 (31.0)	88 (53.3)	<0.0001
Marital status			
Single	25 (15.2)	24 (14.6)	
Married	109(66.5)	117(71.3)	
Separated/divorced	22 (13.4)	15 (9.2)	
Widowed	8 (4.9)	8 (4.9)	0.653
Categorical body mass index[c]			
Normal	59 (35.8)	69 (41.8)	
Overweight	53 (32.1)	52 (31.5)	
Obese	53 (32.1)	44 (26.7)	0.444
Menopausal status			
Premenopausal	25 (15.2)	27 (16.4)	
Perimenopausal	16(9.8)	15 (9.1)	
Postmenopausal	123 (75.0)	123 (74.5)	0.948
Cancer stage at diagnosis			
Stage I	51 (30.9)	58 (35.2)	
Stage II	101 (61.2)	100 (60.6)	
Stage IIIA	13(7.9)	7 (4.2)	0.324

[a] Numbers may vary due to missing values.

[b] Self-reported place of birth of foreign-born participants: for Hispanics: Caribbean (n=7), Central America (n=2), Mexico (n=29), Asia (n = 1), South America (n = 13), and Europe (n=2); for non-Hispanic whites: Africa (n=1), Asia (n=2), Canada (n=5), and Europe (n=9).

[c] Categories of body mass index: normal (18−24.9), overweight (25−29.9), and obese (>30).

Table 2

Baseline reported daily nutrient intake of Hispanic and matched non-Hispanic white breast cancer survivors enrolled in the Women's Healthy Eating and Living Study (N=330)

Nutrient intake	Hispanic (n=165)	Non-Hispanic white (n= 165)	*P* value[a]
	← mean± standard deviation →		
Total energy (kcal)	1,690.8±414.4	1,749.8± 462.5	0.351
Protein (g)	67.9±17.7	70.4±18.4	0.305
Carbohydrates (g)	227.3±60.5	237.65±73.1	0.564
Energy from carbohydrates (%)	54.2±7.9	54.8±8.0	0.549
Cholesterol (mg)	223.7±98.3	207.5± 106.9	0.070
Total fat (g)	58.5±22.5	58.4±22.0	0.811
Energy from total fat (%)	30.3± 6.9	29.3± 6.5	0.155
Monounsaturated fatty acid (g)	22.1 ±8.7	22.1 ± 9.2	0.954
Energy from monounsaturated fatty acid (%)	11.6±3.0	11.2±3.0	0.211
Saturated fatty acid (g)	19.1 ±8.6	19.2± 8.1	0.702
Energy from saturated fatty acid (%)	10.0±2.9	9.7±2.8	0.519
Polyunsaturated fatty acid (g)	12.5±5.7	12.4± 5.2	0.898
Energy from polyunsaturated fatty acid (%)	6.6±2.1	6.3±1.9	0.378
Dietary fiber (g)	19.7± 7.1	20.5±8.1	0.408
Caffeine consumed[b] **(g)**	139.6± 122.8	164.3± 180.7	0.561
Fruit servings+fruit juices[c]	2.7±1.8	3.1±2.1	0.116
Vegetable servings+vegetable juices[c]	2.7±1.7	2.8±1.7	0.398
***α*-Carotene (*μ*g)**	953.9± 2,559.3	1,016.0± 1,474.6	0.114
***β*-Carotene (*μ*g)**	4,800.9± 6,883.4	5,109.4± 4,985.9	0.283
***β*-Cryptoxanthin (*μ*g)**	91.4± 174.8	80.6±120.2	0.601
Lutein+zeaxanthin (*μ*g)	2,377.6± 1,912.9	2,820.3± 2,981.1	0.191
Lycopene (*μ*g)	3,682.0± 3,161.7	3,004.2± 2,719.9	0.029
	← *n (%)* →		
Alcohol intake during reported days			
Yes	98 (59.4)	125 (75.8)	0.001[d]
No	67 (40.6)	40 (24.2)	
Alcohol consumed[e] **(g)**	4.8±7.2	6.7±10.4	0.153
Energy from alcohol[e] **(%)**	2.0±3.1	2.5±3.8	0.335
Caffeine intake during reported days			
Yes	163 (98.8)	160 (97.0)	0.252[d]
No	2(1.2)	5 (3.0)	

NOTE: Information from this table is available online at www.adajournal.org as part of a PowerPoint presentation.

[a] Based on Wilcoxon rank sum test.

[b] Among participants who reported coffee intake.

[c] ½ c=1 serving.

[d] Based on x^2 test.

[e] Among the participants who reported alcohol intake.

Table 3

Univariate and multivariate logistic regression models for alcohol intake during the reported days among Hispanic and matched non-Hispanic white breast cancer survivors enrolled in the Women's Healthy Eating and Living Study (N=330)

Characteristic	Univariate analysis	Multivariate analysis
	← Odds ratio (95% confidence interval) →	
Ethnicity		
Non-Hispanic white	1.00	1.00
Hispanic	0.47 (0.29, 0.75)	0.44 (0.26, 0.74)
Place of birth		
United States	1.00	1.00
Outside the United States	1.09 (0.62,1.92)	1.42 (0.77, 2.61)
Education		
High school	1.00	1.00
Posthigh school/some college	2.98 (1.60, 5.55)	2.66 (1.40, 5.05)
College/university graduate	2.06 (1.16, 3.66)	1.67 (0.91, 3.07)
Body mass index status		
Normal	1.00	1.00
Overweight	1.70 (0.96, 3.02)	1.69 (0.93, 3.08)
Obese	0.99 (0.57, 1.72)	1.18 (0.66, 2.10)
Time since cancer diagnosis		
<2 y	1.00	1.00
≥2 y	1.03 (0.64, 1.67)	0.99 (0.60, 1.63)

Table 4

Ordinal logistic regression models for lycopene consump-tion among the Hispanic and matched non-Hispanic white breast cancer survivors enrolled in the Women's Health Eating and Living Study (N=330)

Characteristic	Univariate analysis	Multivariate analysis
	← Odds ratio[a] (95% confidence interval) →	
Ethnicity		
Non-Hispanic white	1.00	1.00
Hispanic	1.52 (1.03, 2.42)	1.56 (1.04, 2.36)
Place of birth		
United States	1.00	1.00
Outside the United States	1.21 (0.75, 1.95)	1.04 (0.64, 1.72)
Education		
High school	1.00	1.00
Posthigh school/some college	0.95 (0.57, 1.60)	0.96 (0.57, 1.62)
College/university graduate	1.06 (0.65, 1.74)	1.16 (0.69, 1.95)
Body mass index status		
Normal	1.00	1.00
Overweight	1.70 (1.06, 2.72)	1.70 (1.05, 2.73)
Obese	0.97 (0.61, 1.55)	0.94 (0.59, 1.53)
Time since cancer diagnosis		
<2 y	1.00	1.00
≥2 y	1.06 (0.71, 1.59)	1.02 (0.68, 1.54)

[a]The odds ratio reflects the odds of being in a category of higher lycopene consumption than in a category of less lycopene consumption. The multivariate analysis displays results of the odds ratio for ethnicity adjusted for place of birth, education, body mass index, and time since cancer diagnosis.