

Behavioral Correlates of Fruit and Vegetable Intake in Puerto Rico: Results from the Health Information National Trends Survey

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Objective: A diet high in fruit and vegetables (FV) is associated with a decreased risk for chronic diseases, such as cancer. Limited information exists regarding the factors associated with FV intake in persons living in Puerto Rico. The objective of this study was to examine sociodemographic, behavioral, and health-belief factors associated with dietary habits in Puerto Rico.

Methods: Secondary data analysis of adults aged 18 years and older from the Puerto Rico Health Information National Trends Survey (HINTS-PR) conducted in 2009. Multivariate logistic regression models were used to identify factors associated with meeting the established recommendations for FV consumption.

Results: Only 14.5% of the adults in Puerto Rico met the recommendations for daily FV intake, and the vast majority (90.9%) were unaware of current recommendations. Bivariate analyses demonstrated that being obese, having lower than a high school education, and not knowing the recommendations were significantly associated with not meeting these recommendations. In the multivariate logistic regression analysis, being obese (OR = 3.77; 95% CI = 1.41-10.08) and not being aware of the current dietary recommendations (OR = 9.26; 95% CI = 3.77-22.73) continued to be significantly associated with not meeting the FV intake recommendations.

Conclusion: The Puerto Rican population is far from meeting FV consumption recommendations, with prevalence estimates of consumption that are below the US median. Low FV intake might put the population in Puerto Rico at increased risk of developing cancer as well as a number of other chronic diseases that are secondary both to improper nutrition and to obesity. [*P R Health Sci J* 2013;4:194-199]

Key words: Puerto Rico, Fruit and Vegetable Intake Recommendations, Nutrition, HINTS

Among Hispanics, Puerto Ricans are the second largest Hispanic subpopulation (1) and are disproportionately affected by such obesity-related conditions, as metabolic syndrome (2) and diabetes (3,4,5,6). Furthermore, Puerto Ricans who live on the island exhibit higher rates of stomach cancer than do non-Hispanic Whites, or even Puerto Ricans living in the United States (U.S.) (7,8). Data also show that Puerto Ricans have increasing incidence rates of breast (9), colorectal (10), and endometrial cancers (11). Each of these cancers has its own particular strong relationships with obesity and nutritional factors (12).

The Behavioral Risk Factor Surveillance System (BRFSS) estimates that only 17.6% of adults in Puerto Rico consume FV 5 times a day (13). To date, there is very little information regarding the cognitive and behavioral correlates of FV intake in this population. Barriers to FV consumption need to be identified so that public health strategies aimed at overcoming those barriers and positively affecting health behavior can be put into place. Therefore, this study aimed to evaluate the cognitive and behavioral factors associated with adherence to minimum daily recommendations of FV consumption in Puerto Rico.

Methods

HINTS-PR study design and population

We performed a secondary data analysis of the Puerto Rico Health Information National Trends Survey (HINTS-PR) executed in 2009. Data were collected from a representative

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population-based sample in Puerto Rico, using a fully translated version of the 2007 HINTS (English language) instrument developed specifically for Puerto Rico (14). The U.S. National Cancer Institute (NCI) developed HINTS to track population-level trends in cancer-related behavior, knowledge, and attitudes to inform effective health communication strategies across populations. HINTS is distinct from other population data resources, such as BRFSS, in that it examines psychological, cognitive, and communication factors with potential relevance to a range of health behaviors.

A detailed description of the HINTS-US creation and procedures, as well as the survey methodology and instruments used for HINTS (including the exact wording in Spanish of all of the questions that were used in this study), can be found at the official HINTS website (15,16). The specific methodology used for the HINTS-PR survey has been described in detail elsewhere (14). Data were collected from April through June of 2009 at the PR-BRFSS telephone research center using random-digit dialing (RDD) and computer-assisted telephone interviews (CATI). A stratified sampling frame representing the 8 geographic regions of the Puerto Rico Department of Health was employed.

Study participants

Interviews were conducted in Spanish. Selected residential numbers participated in an initial screening interview to select a single eligible person from the household for an extended interview. Per the inclusion criteria, one adult (18 years or older) per household was sampled for the extended interview. The unweighted response rates for the screening and extended interviews were the same, 76.3%.

This research was approved by the IRB of the University of Puerto Rico Medical Sciences Campus.

Measures

FV consumption

For the main dependent variable, we created a dichotomous variable which represents compliance with the current guidelines (17). Compliance of FV consumption was combined and made into a dichotomous variable (daily consumption <5/daily consumption ≥5) represented by the questions “How many servings of fruit do you eat or drink each day?” and “How many servings of vegetables do you eat or drink each day?”

Sociodemographic characteristics

Variables examined included the following: age (≤45 years and >45 years), sex, education (high school graduate/not a high school graduate), occupational status (employed/unemployed), and marital status (married or cohabitating/not married). For determining income cut-offs, because there are no federal poverty guidelines (FPGs) for Puerto Rico, estimates were made by looking at the FPGs for the 48 contiguous states. For the 48 contiguous states, the federal poverty level for a 3-person

household was \$17,170, at the time of publication (18). We decided to use 3 people per household as an estimate since, according to 2006-2008 US census data, the average number of persons per household in Puerto Rico was just slightly above 3 (18). Since the standard of living in Puerto Rico is slightly lower than that of the 48 contiguous states, we decided on \$15,000 per household/respondent as an income cut-off proxy for those living below the FPGs. Therefore, income was categorized as a dichotomous variable (<\$15,000 or ≥\$15,000). Health-related variables, evaluated as predictors of not meeting recommended fruit and vegetable consumption, included body mass index (BMI) (obese [≥30kg/m²] or not obese [<30kg/m²]) and reported number of days per week and amount of time per day of exercise/physical activity.

Physical activity

In order to determine the adherence of the respondents to recommended physical activity guidelines, we used the Physical Activity Guidelines for Americans (19), which recommend that adults get at least 2½ hours a week of moderate-intensity aerobic activity such as walking, 1 hour and 15 minutes a week of vigorous-intensity aerobic activity, such as jogging, or a combination of both.

Cognitive factors and health beliefs

A series of dichotomous questions concerning the participants' beliefs/knowledge regarding certain behaviors potentially associated with cancer risk was also evaluated. For example, if participant answered that he or she totally agreed or somewhat agreed with the statement “There are so many different messages about whether being overweight is harmful to one's health, it is hard to know what weight one should maintain to be healthy,” this answer was categorized as that person's being unsure what a healthy weight is. Responses to the question exploring the respondent's knowledge of FV consumption recommendations for good health (“How many servings of fruit and vegetables do you think the average adult should eat each day for good health?”) were categorized into the following 2 groups: less than 5 or more than 5 servings of fruit and vegetables a day, based on the guidelines for the minimum recommended consumption, which consumption ranges from 5 to 13 servings of FV per day (20).

Statistical analysis

A total of 593 completed interviews were analyzed (98% of the complete interviews). Analyses were conducted using the statistical program SAS version 9 and the option survey sample to take into account the complex sample design (21). All analyses included the overall sample weight and incorporated the jackknife replicate weights to estimate standard errors of point estimates for the complex survey data. Data were weighted according to population estimates for sex, age, education, and marital status from the American Community Survey (ACS) for Puerto Rico to provide representative estimates of the adult population in Puerto Rico.

Descriptive statistics for all variables included in this analysis were calculated. Bivariate analyses between sociodemographic factors, behaviors, and beliefs and the dependent outcomes of interest (recommended FV intake) were conducted using Pearson’s chi-squared test. A P-value of <0.05 was used to determine statistical significance. Separate univariate logistic regression analyses were performed, and those predictors that achieved statistical significance were included in a multivariate logistic regression model. Multivariate analysis was conducted on those variables that achieved statistical significance (P<0.05) in the univariate logistic regression model. All possible first-order interaction terms were assessed in the multivariate regression model using the likelihood-ratio test.

Results

Sample characteristics

Sociodemographic, behavioral, and health-belief characteristics are shown in Table 1. The mean age of the respondents was 46.1 years (SD = 17.5) and more than half were women (54.0%) who were not married or living with a consensual partner at the time of the interview. Less than a quarter (23.9%) reported not having completed high school. With respect to income, 41.4% of the study population earned less than \$15,000 per year, only 7.5% were uninsured, and 6.5% were unemployed (data not shown).

The mean daily fruit intake was 1.6 servings of fruit per day, while vegetable consumption was 1.07 servings per day. The combined mean intake of FV was 2.67 servings per day. According to the results of the survey, only 14.5% of the participants met the recommended minimum of 5 servings of FV per day. Recommendations for daily exercise (2½ hours a week of moderate-intensity aerobic activity, such as walking, or 1 hour and 15 minutes a week of vigorous-intensity aerobic activity, such as jogging) were met by 19.5% of the respondents, while only 4.2% met both the daily exercise and daily FV intake recommendations. Approximately one third of the study population (29%) reported having a BMI of 30kg/m² or higher.

In terms of health beliefs and knowledge regarding risk factors associated with cancer, 40.4% of the respondents reported they did not believe exercise could lower their risk of cancer. More than half (70.9%) said they were unsure of what constituted a healthy weight, and 78.4% thought that obesity was caused mainly by genetics. Less than a quarter (22.7%) believed that diet and exercise did not have much of an effect on obesity. Finally, the vast majority (90.9%) were unaware of the daily recommendations for FV intake.

Covariates associated with recommended FV intake

In the bivariate analyses, several variables were significantly associated with not meeting the minimum recommendation for FV consumption, including having less than a high school education, being obese, being a smoker, and not knowing the

Table 1. Sociodemographic, behavioral, and cognitive characteristics of men and women: HINTS-Puerto Rico Study.

| | N | Weighted % (95% CI) |
|---|-----|---------------------|
| Sociodemographics characteristics | | |
| <i>Sex</i> | | |
| Male | 173 | 46.0 (44.1-47.9) |
| Female | 420 | 54.0 (52.1-55.9) |
| <i>Age Group</i> | | |
| ≤45 years | 140 | 50.7 (47.2-54.2) |
| >45 years | 448 | 49.3 (45.8-52.8) |
| <i>Married or cohabitating</i> | | |
| Yes | 295 | 47.8 (44.2-51.3) |
| <i>Completed high school</i> | | |
| Yes | 410 | 76.1 (71.4-80.8) |
| <i>Income</i> | | |
| <\$15,000 | 162 | 41.4 (32.8-50.0) |
| ≥\$15,000 | 173 | 58.6 (50.0-67.2) |
| Health behaviors | | |
| <i>BMI</i> | | |
| Obese (BMI ≥30) | 152 | 29.0 (23.1-34.9) |
| <i>FV consumption <5 servings/day</i> | | |
| Yes | 93 | 14.5 (9.5-19.6) |
| <i>Exercises ≥30 minutes/day and ≥5 days/week</i> | | |
| Yes | 107 | 19.5 (14.6-24.4) |
| <i>Adheres to minimum daily exercise & fruit/vegetable intake</i> | | |
| Yes | 28 | 4.2 (1.5-6.9) |
| <i>Currently smokes</i> | | |
| Yes | 136 | 20.0 (14.6-25.4) |
| Health beliefs/knowledge | | |
| <i>Believes that exercising lowers cancer risk</i> | | |
| Yes | 339 | 59.6 (53.4-65.8) |
| <i>Is unsure what a healthy weight is</i> | | |
| Yes | 412 | 70.9 (64.7-77.1) |
| <i>Thinks that obesity is mostly genetic</i> | | |
| Yes | 430 | 78.4 (73.8-83.1) |
| <i>Thinks that obesity is mostly caused by poor diet/lack of exercise</i> | | |
| Yes | 431 | 77.3 (72.4-82.3) |
| <i>Is aware that the recommendation for FV is at least 5 servings*</i> | | |
| Yes | 58 | 9.1 (5.2-13.0) |
| <i>Thinks that an individual's behavior can cause cancer</i> | | |
| Yes | 346 | 61.0 (54.9-67.1) |

*Participants responded at least 5 servings of fruit and vegetables to the following question: How many servings of fruit and vegetables do you think the average adult should eat each day for good health?

actual number of daily recommended servings of fruit and vegetables (Table 2).

In the multivariate analysis, those participants who reported being obese had approximately 4 times higher odds of not meeting current dietary recommendations with regard to FV intake (OR = 3.79; 95% CI = 1.41-10.08). Additionally, those participants who reported not being aware of the current dietary recommendations were up to 9 times more likely not to meet the consumption recommendations than were those participants who were aware

of the recommendations (OR = 9.26; 95% CI = 3.77, 22.73). No significant interactions were found among any of the independent variables included in the multivariate model (Table 3).

Discussion

To our knowledge, our study provides the first island-wide representative data in Puerto Rico on the cognitive and behavioral correlates of FV consumption in the adult population. Our results are in agreement with previous findings about the dietary disparity in FV consumption in the adult population in Puerto Rico (12). In our study, only 14.5% of adults living in Puerto Rico reported consuming at least 5 daily servings of FV.

Having lower than a high school education, being obese, being a smoker, and having limited knowledge of FV consumption recommendations for good health were independent predictors of FV intake in this population; but in the multivariate analysis, only being obese and possessing little or incorrect knowledge of the FV consumption recommendations for good health remained as significant correlates of low FV consumption. Our study is the first to look at the cognitive and behavioral correlates of FV consumption in this population, which consumption is alarmingly low, and sheds some light on the potential important predictors of low FV consumption in this group.

Overall, the estimates obtained in this population-based study are comparable to estimates for the same year from the

Table 2. Bivariate analysis of sociodemographic, behavioral, and cognitive characteristics associated with fruit and vegetable intake.

| | Consume at least 5 servings of fruit and vegetables per day (Weighted %) | | Chi-square p-value |
|--|--|--------------|--------------------|
| | Yes (n = 93) | No (n = 500) | |
| Sociodemographics characteristics | | | |
| <i>Sex</i> | | | 0.23 |
| Male | 29 (8.2%) | 144 (37.8%) | |
| Female | 64 (6.3%) | 356 (47.7%) | |
| <i>Age group</i> | | | 0.26 |
| ≤45 years | 22 (8.7%) | 118 (42.0%) | |
| >45 years | 71 (6.0%) | 377 (43.3%) | |
| <i>Married or cohabitating</i> | | | 0.77 |
| No | 40 (8.0%) | 243 (44.3%) | |
| Yes | 50 (6.6%) | 245 (41.1%) | |
| <i>Completed high school</i> | | | 0.04 |
| No | 20 (2.1%) | 145 (21.9%) | |
| Yes | 70 (12.6%) | 340 (63.4%) | |
| Health behaviors | | | |
| <i>BMI</i> | | | <0.001 |
| Not obese | 75 (13.3%) | 337 (57.8%) | |
| Obese | 16 (1.7%) | 136 (27.3%) | |
| <i>Currently smokes</i> | | | 0.04 |
| No | 76 (12.9%) | 376 (67.2%) | |
| Yes | 17 (1.7%) | 119 (18.2%) | |
| Health beliefs/knowledge | | | |
| <i>Believes that exercising lowers cancer risk</i> | | | 0.87 |
| No | 29 (5.5%) | 172 (34.9%) | |
| Yes | 57 (8.7%) | 282 (50.9%) | |
| <i>Is unsure what a healthy weight is</i> | | | 0.24 |
| No | 31 (5.8%) | 143 (23.3%) | |
| Yes | 62 (8.9%) | 350 (62.0%) | |
| <i>Thinks that obesity is mostly genetic</i> | | | 0.49 |
| No | 19 (2.4%) | 119 (19.2%) | |
| Yes | 69 (12.3%) | 361 (66.2%) | |
| <i>Thinks that obesity is mostly caused by diet/exercise</i> | | | 0.80 |
| No | 25 (3.0%) | 127 (19.7%) | |
| Yes | 67 (11.0%) | 364 (66.3%) | |
| <i>Responded at least 5 servings of FV for good health*</i> | | | <0.001 |
| No | 64 (9.4%) | 471 (81.5%) | |
| Yes | 29 (5.1%) | 29 (4.0%) | |
| <i>Thinks that an individual's behavior can cause cancer</i> | | | 0.28 |
| No | 34 (4.7%) | 185 (34.3%) | |
| Yes | 57 (10.2%) | 289 (50.7%) | |

*Participants responded at least 5 servings of fruit and vegetables to the following question: How many servings of fruit and vegetables do you think the average adult should eat each day for good health?

BRFSS- PR (17.7%; 95% CI = 16.2%-19.3%) (12). However, estimates of FV intake from the US national HINTS survey are twice as high (35.6%) (22). Therefore, Puerto Rico shows even lower prevalence estimates of consumption, which estimates are below those of the overall population in the US, in general, and those of US Hispanics, in particular. Our adjusted results show that having a lack of knowledge of the minimum recommendations was one of the main predictors of low FV intake. Being unaware to FV consumption recommendations has been previously reported as a predictor of not meeting recommended FV consumption guidelines among other (non-Hispanic) minorities in the US (23). Low educational attainment and a lack of knowledge with regard to the minimum FV consumption recommendations might also be indicators of low socioeconomic status (SES), which has, in turn, been associated with both lower FV consumption and a higher risk of chronic diseases, including cancer (24,25).

Obesity, the other main correlate of low FV consumption in this study, was highly prevalent in our sample (30% of the respondents were obese). The BRFSS-PR has also shown that

Table 3. Logistic regression models predicting factors associated with fruit and vegetable intake.

| | Model 1* | | Model 2** | |
|--|--------------------|---------|-------------------|---------|
| | OR (95% CI) | P-value | OR (95% CI) | P-value |
| Sociodemographic characteristics | | | | |
| Sex | | 0.23 | | 0.22 |
| Male | 1.0 | | 1.0 | |
| Female | 0.60 (0.27-1.38) | | 0.59 (0.26-1.36) | |
| Age groups | | 0.27 | | 0.92 |
| ≤45 years | 0.67 (0.33-1.36) | | 0.96 (0.48-1.95) | |
| >45 years | 1.0 | | 1.0 | |
| Completed high school | | 0.05 | | 0.37 |
| No | 2.12 (1.00-4.48) | | 1.49 (0.62-3.55) | |
| Yes | 1.0 | | 1.0 | |
| Health behaviors | | | | |
| BMI | | 0.002 | | 0.008 |
| Not obese | 3.68 (1.61-8.43) | | 3.77 (1.41-10.08) | |
| Obese | 1.0 | | 1.0 | |
| Currently smokes | | 0.08 | | 0.17 |
| No | 1.0 | | 1.0 | |
| Yes | 2.01 (0.93-4.36) | | 1.70 (0.79-3.67) | |
| Health beliefs/knowledge | | | | |
| Responded "at least 5 servings of FV for good health"*** | | < 0.001 | | <0.001 |
| No | 10.93 (4.21-28.35) | | 9.26 (3.77-22.73) | |
| Yes | 1.0 | | 1.0 | |

*Crude model; **Fully adjusted model; ***This is response to the following question: 'How many servings of fruit and vegetables do you think the average adult should eat each day for good health?'

the prevalence of obesity is higher (27.5%) than it is in the US (26.9%), although it is still lower in Puerto Ricans living in PR than it is in US Hispanics (29.2%) (12). Ho and colleagues have shown that Puerto Ricans living on the island and those living in NYC have comparable rates of obesity prevalence, and these investigators suggest that the traditional diet of island residents (which is shared by their immigrant counterparts in the US) includes a low diversity of FV consumption and is, for that reason among others, unhealthful (26). Determining whether or not the high prevalence of obesity in Puerto Rico can be attributed to the lack of FV diversity in the Puerto Rican diet (itself subject to the affordability and availability of FV to island families) requires further research. Furthermore, this study also indicates that a large proportion of study participants interviewed did not know what a healthy weight was and did not believe that diet and exercise had anything to do with obesity or cancer, contrasting with findings from a recent study utilizing the US HINTS database (20).

Our study is subject to limitations. First, because HINTS-PR was a telephone-based survey, it includes data only from those residents who have a working landline phone and, thus, does not include data from households without telephones or from those served only by cell phones. Consequently, the above data may not be generalizable to the entire adult Puerto Rican population. Nonetheless, response rates in the 2009 HINTS-

PR were much higher than those reported for HINTS in the US for 2007, giving support to the notion that this is a truly representative population. Second, the prevalence estimates were based on self-reported information derived from only a few survey questions about diet, which are always subject to recall and social desirability biases, particularly for self-reports of complex behaviors such as eating habits. That this study relies solely on self-reported consumption estimates contributes to a certain lack of reliability, which also must be considered as another of its limitations. Despite this limitation, the estimates of FV intake from HINTS were similar to those derived from the more in-depth set of questions asked in the BRFSS-PR and highlight the need to rigorously apply a more precise measure when addressing FV intake in Puerto Rico. In summary, the low FV consumption reported in Puerto Rico is correlated both with the lack of awareness of FV intake recommendations and with obesity. Further research is needed to better understand the individual, environmental, and food system factors that influence FV consumption in this population. Disparities in education as well as other socioeconomic factors clearly lie at the root of the disparities of knowledge, behavior, and, ultimately, health. Policy, environmental, and educational approaches aimed at increasing FV consumption and continued research to document FV intake in Puerto Rico are encouraged.

Resumen

Objetivo: Una dieta rica en frutas y verduras (FV) está asociada con un menor riesgo de enfermedades crónicas, tales como el cáncer. Existe información limitada con respecto a los factores asociados a la ingesta de FV entre las personas que viven en Puerto Rico. El objetivo de este estudio fue el analizar los factores sociodemográficos, de comportamiento y de creencias de salud asociados con los hábitos dietéticos en Puerto Rico. **Métodos:** Análisis secundario de datos del estudio poblacional conocido en inglés como el Puerto Rico Health Information National Trends Survey (HINTS-PR). El estudio fue llevado a cabo en el 2009 entre personas mayores de 18 años. Modelos multivariados de regresión logística se utilizaron para identificar los factores asociados con el cumplimiento de las recomendaciones establecidas por el consumo de FV. **Resultados:** Sólo el 14.5% de los adultos en Puerto Rico cumplieron las recomendaciones para la ingesta diaria de FV, y la gran mayoría (90.9%) no tenían conocimiento de las recomendaciones actuales. El análisis bivariado demostró

que el ser obeso, haber completado cuarto año, y el no conocer las recomendaciones establecidas para el consumo de FV, se asociaron significativamente con el incumplimiento de estas recomendaciones nutricionales. En el análisis multivariado, el ser obeso (OR = 3.77; IC 95% = 1.41-10.08) y el no conocer las recomendaciones dietéticas actuales (OR = 9.26; IC 95% = 3.77-22.73) mantuvieron su significatividad con el incumplimiento de las recomendaciones de ingesta de FV. Conclusión: La población de Puerto Rico está lejos de cumplir las recomendaciones de consumo de FV, con estimaciones de prevalencia de consumo por debajo de la mediana de los Estados Unidos. Este estudio pone de manifiesto el bajo cumplimiento de actuales recomendaciones dietéticas. Menor consumo de FV podría poner a la población de Puerto Rico en mayor riesgo de desarrollar cáncer, así como una serie de otras enfermedades crónicas asociadas a la baja ingesta de FV y la obesidad.

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