

Household Income Disparities in Fruit and Vegetable Consumption by State and Territory: Results of the 2009 Behavioral Risk Factor Surveillance System

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ABSTRACT

Few studies take into account the influence of family size on household resources when assessing income disparities in fruit and vegetable (F/V) consumption. Poverty income ratio (PIR) is a measure that utilizes both reported income and household size. We sought to examine state-specific disparities in meeting Healthy People 2010 objectives for F/V consumption by percent PIR. This analysis included 353,005 adults in 54 states and territories reporting data to the 2009 Behavioral Risk Factor Surveillance System in the United States. Percent PIR was calculated using the midpoint of self-reported income range and family size. The prevalences consuming at least two fruits and at least three vegetables per day were examined by percent PIR (<130% [greatest poverty], 130% to <200%, 200% to <400%, and \geq 400% [least poverty]). The percent of adults consuming vegetables at least three times daily was significantly lower (21.3%) among those living at greatest poverty (<130% PIR) compared with 30.7% among those with least poverty (\geq 400% PIR). Daily consumption of vegetables at least three times was significantly lower among those with greatest poverty in a majority of states and territories surveyed (43 of 54). The overall percent of adults consuming fruits at least 2 times daily was also lower among those living at greatest vs least poverty, but the difference was smaller (32.0% vs 34.2%), with 14 states reporting a difference that was significantly lower among those with greatest poverty. Our study revealed that in 2009 a significantly lower proportion of US adults living at greatest poverty consumed fruits at least two times daily or vegetables at least three times daily compared with those with the least poverty, with greater disparity in vegetable intake. Policy and environmental strategies for increased affordability, access, availability, and point-of-decision information are approaches that may help disparate households purchase and consume F/V.

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A HIGHER DIETARY INTAKE OF FRUITS AND vegetables (F/V) may reduce the risk for chronic diseases, including coronary heart disease,¹ and some cancers,² and additionally may aid in weight management.^{3,4} The 2010 Dietary Guidelines for Americans (DGA) recommends increased consumption of F/V, with an emphasis on dark green, orange, and red vegetable subgroups, along with peas and beans.⁵ Despite known benefits, F/V consumption among American adults remains low.⁶⁻⁸ In a study of trends in F/V intake from 2000 to 2009, the percent of adults consuming fruit at least two times daily decreased slightly from 34.4% to 32.5%, although the percent consuming vegetables at least three times daily remained constant (26.7% in 2000 to 26.3% in 2009).⁷

A lack of available F/V in communities⁹ as well as a lack of knowledge of the benefits of consuming all forms of F/V⁵ may be a factor in lower intakes. Cost may also contribute to low intakes.¹⁰ A US Department of Agriculture (USDA) study re-

vealed that that an average daily expenditure of \$2 to \$2.50 per person could purchase enough F/V to meet DGA recommendations.¹¹ For a family of four, this would represent up to \$70/week on F/V, which may exceed what some families can afford to spend.

During 2000, the US Department of Health and Human Services called for improved F/V consumption by 2010 through the national, science-based Healthy People objectives.¹² The state-based Behavioral Risk Factor Surveillance System (BRFSS) allows states and territories to monitor F/V intake across the United States and to assess progress towards Healthy People objectives. However, previous nationwide analyses of F/V intake did not account for the influence of family size on household resources when assessing consumption by income, nor assess socioeconomic disparities within states and territories.^{7,13,14} The objective of our study was to examine disparities in adult F/V consumption by percent poverty income ratio (PIR), both nationwide and within states

and territories. Our study hypothesized that adults living with a lower PIR would report a lower consumption of F/V.

METHODS

This study analyzed data from the 2009 BRFSS, which is a random-digit dialed telephone survey conducted by the Centers for Disease Control and Prevention that collects health risk data from all 50 states, the District of Columbia, Guam, Puerto Rico, and the Virgin Islands. The target population is noninstitutionalized individuals aged ≥ 18 years with access to a landline telephone. Cross-sectional data are collected on behaviors, health care access, and chronic disease status with self-reported demographic characteristics.¹⁵ This analysis uses PIR as a measure of income level, accounting for household size. The US Census Bureau publishes federal poverty thresholds for family size (eg, the federal poverty threshold for a family of two is \$14,570). Calculations of percent PIR compared household size and the midpoint of self-reported income range as a percentage of the federal poverty thresholds. The response categories of the income variable and the midpoints (shown in parentheses) used in this calculation were $< \$10,000$ (\$5,000), $\$10,000$ to $< \$15,000$ (\$12,500), $\$15,000$ to $< \$20,000$ (\$17,500), $\$20,000$ to $< \$25,000$ (\$22,500), $\$25,000$ to $< \$35,000$ (\$30,000), $\$35,000$ to $< \$50,000$ (\$42,500), $\$50,000$ to $< \$75,000$ (\$62,500), and $\geq \$75,000$ (\$87,500). The midpoint of self-reported income range was divided by the specific poverty threshold for household size with the quotient multiplied by 100 to obtain percent PIR.¹⁶ For example, the percent PIR for a household size of two with a self-reported income of \$35,000 to $< \$50,000$ would be calculated as follows: $(\$42,500$ [midpoint of income range]/ $\$14,570$ [poverty threshold for household size of two]) $\times 100 = 292\%$ PIR. Poverty categories were based on Supplemental Nutrition Assistance Program (SNAP) benefit eligibility. Individuals with an income of $< 130\%$ of the federal poverty level are eligible for benefits. Other income categories included 130% to $< 200\%$, 200% to $< 400\%$, and $\geq 400\%$. Individuals living with greatest poverty are those with a percent PIR $< 130\%$, whereas those with the least poverty have a percent PIR $\geq 400\%$.

F/V intake was determined from the six-item F/V frequency screener that is part of the survey questionnaire. The screener asked respondents about intake of fruit juice, fruit, green salad, potatoes (not including french fries, fried potatoes, or potato chips), carrots, and other vegetables (not separately queried) during the past 30 days. Participants are not given a definition of serving size. Responses about intake of fruit juice and fruit comprised the total daily frequency of fruit consumption, with total daily vegetable consumption obtained from the remaining items. Participants may respond in terms of daily, weekly, monthly, and yearly F/V consumption. Daily consumption was computed from summed responses by dividing by seven for weekly frequencies, 30 for monthly frequencies, and 365 for yearly frequencies.

Healthy People 2010 objectives for improving the nation's health included fruit consumption and vegetable consumption objectives, which were for 75% of the population aged at least 2 years to consume at least two daily servings of fruit and for 50% of the population aged at least 2 years to consume at least three daily servings of vegetables.¹² This analysis determined the percent of individuals

consuming fruits at least two times daily and vegetables at least three times daily.

The initial dataset contained 428,899 respondents; the analytic sample was composed of 353,005 adults with data on F/V consumption, income, and household size. Individuals were excluded if more than one response was missing for the F/V screener items ($n=24,987$), if there were unlikely values (≥ 25 times) for total daily intake of F/V ($n=139$), if values were missing for self-reported income data ($n=49,009$), or if values for household size were more than seven persons (the 99th percentile of household size from the 2007-2008 National Health and Nutrition Examination Survey [NHANES] [$n=1,759$]). Descriptive statistics and linear contrasts were performed using the Statistical Analysis Software (version 9.2, 2008, SAS Institute, Inc) and SAS-Callable SUDAAN (version 10, 2008, Research Triangle Institute) accounting for complex survey design. Linear contrasts tested selected pairwise comparisons of percent PIR domains on the prevalence of daily F/V intake with a referent of $\geq 400\%$ PIR. Calculations of percent contributions of separate fruit or vegetable items to total fruit or vegetable intake were calculated as an average of (number of times per day consumed an individual fruit or vegetable item/number of times per day consumed total fruits or vegetables) $\times 100$. Multiple logistic regression analyses assessed the odds of reporting consuming at least two fruits daily and the odds of reporting consuming at least three vegetables daily adjusting for sex, age, and race/ethnicity.

RESULTS AND DISCUSSION

F/V consumption was low overall; only 32.4% of adults reported consuming fruit at least two times daily and only 26.3% reported consuming vegetables at least three times daily. There was some variation in daily intake by sociodemographic characteristics among the sample of respondents (Table 1). Both F/V consumption estimates were higher among women, individuals aged ≥ 65 years, and college graduates, whereas Hispanic respondents consumed more fruit and non-Hispanic whites consumed more vegetables. All of these comparisons were statistically significant, although some may be due to a large overall sample size.

F/V intake varied considerably by percent PIR, both overall and among individuals in states and territories, with greater disparity evident for vegetables compared with fruit. Overall, the percent of adults consuming fruit at least two times daily was slightly, yet significantly lower for adults in all PIR categories $< 400\%$ compared with those living at $\geq 400\%$ PIR (Table 2). Individuals living with greatest poverty were less likely to report fruit consumption at least two times daily compared with individuals living with least poverty (adjusted odds ratio 0.78, 95% CI 0.74 to 0.81). The percent of adults consuming vegetables at least three times daily was also significantly lower for all PIR groups $< 400\%$ compared with the PIR category representing the least poverty. Although nearly 31% of adults living with the least poverty reported consumption of vegetables at least three times daily, only 21% of adults living at greatest poverty reported this intake (Table 2) (adjusted odds ratio 0.66, 95% CI 0.62 to 0.69).

In 14 states, the proportion of adults consuming fruit at least two times daily was significantly lower among those with greatest poverty. Only one state, Alabama, reported the reverse, with a significantly higher proportion of adults at

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