



Fruit and vegetable consumption and food values: National patterns in the United States by Supplemental Nutrition Assistance Program eligibility and cooking frequency[☆]



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ABSTRACT

Background. More frequent cooking at home may help improve diet quality and be associated with food values, particularly for individuals participating in the Supplemental Nutrition Assistance Program (SNAP).

Objective. To examine patterns of fruit and vegetable consumption and food values among adults (aged 20 and older) in the United States, by SNAP participation and household cooking frequency.

Methods. Analysis of cross-sectional 24-hour dietary recall data obtained from the National Health and Nutrition Examination Survey 2007–2010 (N = 9560).

Results. A lower percentage of SNAP participants consumed fruit (total: 35% vs. 46%, $p = 0.001$; fresh: 30% vs. 41%, $p < 0.001$) and vegetables (total: 49% vs. 58%, $p = 0.004$; fresh: 35% vs. 47%, $p < 0.001$) than those ineligible for SNAP. Among SNAP participants, cooking >6 times/week was associated with greater vegetable consumption compared to cooking <2 times/week (175 g vs. 98 g, $p = 0.003$). SNAP-eligible individuals who cooked ≥ 2 times/week were more to report price (medium cookers: 47% vs. 33%, $p = 0.001$; high cookers: 52% vs. 40%, $p < 0.001$), ease of preparation (medium cookers: 36% vs. 28%, $p = 0.002$; high cookers: 36% vs. 24%, $p < 0.001$) and how long food keeps (medium cookers: 57% vs. 45%, $p < 0.001$; high cookers: 61% vs. 50%, $p < 0.001$) as important compared to SNAP-ineligible individuals.

Conclusions. Fruit and vegetable consumption in the United States is low regardless of cooking frequency. Efforts to improve diet quality should consider values on which food purchases are based.

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Introduction

In response to persistently high rates of obesity and associated weight-related diseases (Flegal et al., 2010; Ogden et al., 2007; Olshansky et al., 2005), particularly among low-income populations (Drewnowski, 2009), the potential for home cooking to improve diet quality is attracting increasing interest in the United States (Bowen et al., 2014; Condrasky et al., 2010; Hartmann et al., 2013; Lichtenstein and Ludwig, 2010; Mancino and Gregory, 2012; Smith et al., 2013; Virudachalam et al., 2013). Foods consumed at home and greater cooking frequency are, on average, associated with better diet quality (Lin and Guthrie, 2012; Todd et al., 2010; Wolfson and Bleich, 2014). Although Americans spend less time cooking than in the past (Hamrick et al., 2011; Kolodinsky and

Goldstein, 2011; Smith et al., 2013; Zick and Stevens, 2010), across all income groups people report cooking frequently (5 times/week) (Wolfson and Bleich, 2014).

The Supplemental Nutrition Assistance Program (SNAP) provided more than \$75 billion in benefits to approximately 47 million Americans in 2013 (United States Department of Agriculture, 2014a). As SNAP transitioned from a primary focus on reducing hunger and food insecurity, funding for SNAP education (SNAP-Ed), SNAP's obesity prevention and nutrition education initiative, increased from \$661 thousand when it began in 1992 to \$379 million in 2010 (United States Department of Agriculture, 2014b). SNAP-Ed aims to help participants make healthy food choices within their limited budget, including increasing fresh fruits and vegetable consumption, a key goal of the *Dietary Guidelines for Americans* (United States Department of Agriculture, 2014c; United States Department of Agriculture et al., 2010). Encouraging home cooking is a key strategy for achieving this goal, and in addition to other program activities, SNAP-Ed catalogs budget friendly recipes targeted to participants on their website (United States Department of Agriculture). Findings regarding the relationship between SNAP participation and diet quality are mixed; some evidence indicates

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that SNAP participation improves diet quality (Gleason et al., 2000; Gregory et al., 2013), and increases fruit and vegetable consumption (Gregory et al., 2013) whereas other studies show the opposite (Cole and Fox, 2008; Leung et al., 2012; Middaugh et al., 2012).

Numerous interventions focus on increasing access to fruits and vegetables, and promoting healthy eating through educational programs including cooking classes (Bish et al., 2005; Cohen et al., 2012; Condrasky et al., 2010, 2011; Cooking Matters, 2014; Davis et al., 2011; Flynn et al., 2013; Garber, 2007; Gittelsohn et al., 2010; Levy and Auld, 2004; Olsen et al., 2012; Tessaro et al., 2006; Young et al., 2013). These programs often target low-income Americans who typically consume fewer fruits and vegetables. However, all Americans, regardless of income, do not consume the recommended daily servings of fruits and vegetables (Casagrande et al., 2007; Grimm et al., 2012; Kirkpatrick et al., 2012; Lin et al., 2013; Middaugh et al., 2012). Prior research indicates that cooking frequency, complexity, and confidence are associated with increased fruit and vegetable consumption (Lang et al., 1999; Larson et al., 2006; McLaughlin et al., 2003). In contrast, other evidence suggests that more time spent cooking is not associated with increased vegetable consumption (Mancino and Gregory, 2012).

Food values (beliefs which motivate food selections) may, in turn, influence the decision to cook. The values which shape food choices (taste, price, convenience, quality, nutrition) (Furst et al., 1996; Glanz et al., 1998) are similar to commonly cited barriers to healthy home cooking – time, price, convenience and cooking knowledge/skills and confidence (Caraher et al., 1999; Celnik et al., 2012; Soliah et al., 2012). Evidence about whether individual values related to food purchasing differ by cooking frequency is missing from the literature.

The primary purpose of this descriptive study is to examine patterns of fruit and vegetable consumption among U.S. adults by SNAP status and cooking frequency. We additionally describe differences in food purchase values by SNAP status and cooking frequency. The key contributions of this study are updating prior estimates of fruit and vegetable consumption by SNAP status and examination of whether this relationship is modified by cooking frequency. A better understanding in this area may identify modifiable behavioral targets to increase the frequency of cooking at home, particularly among low-income Americans who are eligible for SNAP.

Methods

Data and design

Data was obtained by combining two waves of data collection (2007–2008 and 2009–2010) from the National Health and Nutrition Examination Survey (NHANES). The NHANES is a cross-sectional, nationally representative, population-based survey designed to collect information on the health status, nutritional intake and health-related behaviors of the U.S. population. Participants are selected based on a multi-stage, clustered, probability sampling strategy (Centers for Disease Control, 2009). A complete description of data-collection procedures and analytic guidelines are available elsewhere (www.cdc.gov/nchs/nhanes.htm). Analysis was restricted to data from 2007 to 2010 based on the availability of key variables of interest.

Study sample

The study sample included adults aged 20 and older with complete and reliable single 24-hour dietary recalls (as determined by the NHANES staff). Survey respondents were excluded if they were pregnant or had diabetes at the time of data collection ($N = 1491$) due to differences in dietary requirements for these groups compared to the general population. We also excluded individuals from analysis who lacked complete information on the key independent variables of interest (defined in detail below): nine individuals who responded with a cooking frequency greater than 7 days, 112 individuals with missing values for cooking frequency, and nine individuals with missing information on SNAP status were excluded from analysis. Missingness for both cooking

frequency and SNAP status represented 0.01% of the total sample. The final analytic sample included 9560 adults all of whom had complete cooking frequency, SNAP status and dietary recall data.

Measures

Cooking frequency status

Cooking frequency was assessed by the survey question, “During the past seven days, how many times did you or someone else in your family cook food for dinner or supper at home?” Household cooking frequency was categorized into three groups based on the definition in the existing literature (Virudachalam et al., 2013; Wolfson and Bleich, 2014): low (0 to 1 time, $N = 802$), medium (2 to 5 times, $N = 3704$) and high (6 to 7 times, $N = 5063$).

SNAP status

SNAP eligibility is determined by having a household income $\leq 130\%$ of the federal poverty level (FPL) and \$2000 in countable assets (United States Department of Agriculture, 2013). Consistent with prior literature, SNAP status was defined three ways based on self-reported SNAP participation and self-reported household income: 1) receiving SNAP; 2) income-eligible but not receiving SNAP; and 3) income-ineligible for SNAP (Bleich et al., 2013).

Fruit and vegetable consumption

Fruits and vegetables were defined two ways; 1) total fruits/vegetables including raw, fresh, frozen, canned, dried and pickled, and 2) fresh fruits/vegetables including only raw or cooked from raw. White potatoes and sauces (e.g., tomato sauce) were excluded from the vegetable category. White potatoes and tomato sauce comprise almost half of average daily vegetable consumption in the U.S. (Lin et al., 2013). Potatoes and tomato sauce are associated with higher intake of sodium and total calories (Lin et al., 2013). By excluding potatoes and tomato sauce from our analysis we restrict our vegetable category to other vegetables associated with higher fiber and low caloric intake, the increased consumption of which is recommended by the *Dietary Guidelines for Americans* (United States Department of Agriculture et al., 2010). For complete fruit and vegetable definitions see Appendix A.

Food purchase values

Food purchase values were based on responses to questions assessing the importance of several domains (price, nutrition, taste, ease of food preparation, how well food keeps) related to food purchasing. Thus, food purchase values refer to how important the above are to individuals when making decisions about what food to purchase. Response categories to these survey questions were very important, somewhat important, not too important, or not at all important. Food purchase values were dichotomized as very important vs. otherwise based on the cut points in the data. Twenty percent of individuals in the dataset were excluded from the analysis due to missing information for all food values. The outcomes of fruit and vegetable consumption (percent of people consuming and volume of consumption) did not differ systematically between individuals with complete food values data and those without with the exception of the percent of people consuming total fruit (which was higher in the group with complete information on food values, $p = 0.01$).

Socioeconomic and demographic study covariates

Covariates for this analysis included gender, race/ethnicity (non-Hispanic white, non-Hispanic Black, Hispanic, other), age (20–44, 45–64, ≥ 65), education (<high school, high school or GED, >high school), marital status (married, not currently married), employment status (not employed, part time (1–34 h), and full time (≥ 35 h)), country of birth (US born, born in another country), household size (1–3 person household, ≥ 4 person household) and household food security. Household food security is measured in NHANES via an 18-question questionnaire and then categorized (by the NHANES staff) based on those measures into four categories: full, marginal, low and very low food security (Bickel et al., 2000). For this analysis, the low and very low categories were collapsed based on cut points in the data.

Analysis

All analyses used appropriate survey weights to account for the unequal probability of being selected due to the complex sampling

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