



Original article

Weekend-weekday differences in diet among U.S. adults, 2003–2012



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ABSTRACT

Purpose: Dietary patterns differ by day of the week. This study examined weekend-weekday differences in diet among U.S. adults.

Methods: Nationally representative data of 11,646 adults 18 years of age and above from the National Health and Nutrition Examination Survey 2003–2012 waves were analyzed. Individual fixed-effect regressions were performed using data from two nonconsecutive 24-hour dietary recalls.

Results: Weekend diet was less healthful than weekday, with diet on Saturday the worst. Compared with weekday consumption, consumption on Saturday was associated with an increase in daily intakes of total energy by 181.04 kcal, energy from sugar-sweetened beverages 18.34 kcal, energy from alcohol 46.65 kcal, energy from discretionary foods 48.77 kcal, total fat 8.16 g, saturated fat 2.88 g, sugar 5.37 g, sodium 205.59 mg, and cholesterol 43.17 mg, a decrease in intakes of fruit by 13.90 g, vegetable 16.76 g, and fiber 0.67 g, a decrease in the Healthy Eating Index-2010 score by 2.32, and an increase in the prevalence of fast-food and full-service restaurant consumption by 10.21% and 17.79%, respectively. Weekend-weekday differences in diet varied by sex, age, race and/or ethnicity, education, income, and body weight status.

Conclusions: Americans' weekend consumption was associated with increased calorie intake and poorer diet quality.

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Introduction

Improving diet quality is a key health promotion strategy [1]. Since 1980, a major theme of the U.S. federal dietary guidelines has been to increase consumption of nutrient-rich foods and reduce consumption of energy-dense foods [2]. However, a large majority of the American population fails to meet these guidelines, with insufficient consumption of nutrient-rich foods and excessive discretionary calorie intake [3].

Human activities consist of many repeated patterns and habitual behaviors. People's day-to-day lives are punctuated by work, education, and other routines. Alternations of these routines such as not working in paid employment or attending school on the weekend may lead to changes in dietary patterns [4]. Eating out tends to be more common in weekends than in weekdays, and weekend food consumption has been consistently linked to

increased discretionary calorie intake from energy-dense, nutrient-poor foods [5,6].

Previous research on weekend-weekday differences in dietary patterns covered diverse populations (e.g., children [7–13], adolescents [7,8,10,11,13,14], young adults [8,10,15–17], middle-aged and older adults [8,10,15–18], overweight/obese individuals [12,16]) residing in different countries (e.g., Canada [10], Denmark [7,13], United States [8,11,17–19], Korea [20], and other countries [9,12]). In general, these studies reported less healthful dietary intakes in weekends in comparison to weekdays. However, four issues remain to be adequately addressed. First, a large majority of studies used cross-sectional methods [7–13,15,17] and/or non-nationally representative data [12,14,16–20], with findings susceptible to confounding bias (due to failure in controlling for between-individual differences in characteristics such as food or taste preferences) and compromised in generalizability to the general population. Second, dietary outcomes were typically limited to total calories, fats and/or a few individual food items [7–9,12–20], whereas overall diet quality and source of foods (e.g., food/beverage from fast-food/full-service restaurant) were under-examined. Third, most studies grouped Friday, Saturday, and Sunday together (or Saturday and Sunday together) in analysis [7–20],

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which overlooked the distinctive dietary pattern on each of these three weekend days. Finally, population heterogeneities in weekend-weekday differences in dietary patterns may be present but are largely undocumented [21].

Built on previous literature, this study examined weekend-weekday differences in diet among U.S. adults using data from a nationally representative survey. To our knowledge, this study serves as the first attempt to study weekend-weekday differences in diet using a panel data approach, which used within-individual variations in diet between the two nonconsecutive 24-hour dietary recall days (one on weekday and one on weekend) and thus addressed the confounding issue due to unobservable individual characteristics like taste preferences. We hypothesized that weekend diet was less healthful than weekday diet, and the differences were heterogeneous across population subgroups.

Methods

Survey setting and participants

Individual-level data came from the National Health and Nutrition Examination Survey (NHANES) 2003–2004, 2005–2006, 2007–2008, 2009–2010, and 2011–2012 waves. Since 1999, NHANES has been conducted continuously in 2-year cycles and focused on a variety of health and nutrition measurements [22]. A multistage probability sampling design is used to select participants representative of the civilian, noninstitutionalized U.S. population.

Dietary interview

Except for the NHANES 1999–2000 wave where all respondents were asked to complete a single 24-hour dietary recall interview, all subsequent waves incorporated two dietary recalls, with the first collected in-person and the second by telephone 3 to 10 days later. After the dietary interview, the calorie and nutrient contents of each reported food and/or beverage item were systematically coded with the U.S. Department of Agriculture (USDA) Food and Nutrient Database for Dietary Studies. Access restrictions apply to the day 2 dietary recall data collected in the NHANES 2001–2002 wave, whereas dietary data for both recall days are released to the public for all subsequent waves.

Among the 23,865 U.S. adults, 18 years of age and above who participated in the NHANES 2003–2012 waves, 1352 (5.7%) who were pregnant, lactating, and/or on a special diet to lose weight at the time of interview were excluded. Of the remaining 22,513 adults who had complete dietary measures, only those whose two dietary recall days occupied a weekday and a weekend contributed to the individual fixed-effect estimation. Therefore, the effective sample sizes (number of individuals) were 11,646 for all adults, and 5812, 5834, 5524, 2457, 2930, 8883, 2763, 5478, 5315, 3444, 3417, 3932, 3423, 3885, and 3960 for male adults, female adults, white adults, African American adults, Hispanic adults, adults 18–64 years of age, adults 65 years of age and above, adults with high school or lower education, adults with college and above education, adults of low household income level, adults of middle household income level, adults of high household income level, normal weight adults, overweight adults, and obese adults, respectively.

Sugar-sweetened beverage and alcohol consumption

Sugar-sweetened beverage (SSB) includes sodas, fruit drinks, energy drinks, sports drinks, and sweetened bottled waters, consistent with definitions reported by the Centers for Disease

Control and Prevention and the National Cancer Institute [23,24]. Milk (plain or flavored) and 100% fruit juice were excluded. Alcohol includes beers and ales, cordials and liqueurs, cocktails, wines and distilled liquors, consistent with the USDA Food and Nutrient Database for Dietary Studies food and/or beverage categorization. In the NHANES 2011–2012 wave, SSB and alcohol consist of 48 and 33 reported beverage items, respectively. The number of reported items in each beverage category differed only slightly across survey waves.

Discretionary food consumption

The discretionary food category identifies energy-dense, nutrient-poor food products that do not belong to the main food groups or necessarily contain essential nutrients that the human body requires but may add diversity [25]. Foods in this category may be consumed “sometimes in small amounts by those who are physically active, but are not a necessary part of the diet” [25]. Following Bleich et al. (2014) [26], specific food items in the discretionary food category include cookies, pies, ice cream, confectionery, chocolate, other desserts (e.g., custards, puddings, mousse, gelatin dessert), sweet rolls, waffles, cakes, pastries (e.g., crepes, cream puffs, strudels, croissants, muffins, sweet breads), biscuits, hush puppies, chips, popcorn, pretzels, party mixes, and fries. In the NHANES 2011–2012 wave, the discretionary food category consists of 661 reported food items. The number of reported items in the discretionary food category differed only slightly across survey waves.

Calorie intake

In the NHANES dietary interview data, calorie derived from each consumed food or beverage item was recorded based on the quantity of food and/or beverage reported and the corresponding energy contents. We calculated total calorie intake, calorie intake from SSB and alcohol, and calorie intake from discretionary foods for each survey participant on a dietary recall day.

Diet quality

The Healthy Eating Index (HEI)-2010 was developed by the USDA as a measure of dietary quality in accordance with the 2010 Dietary Guidelines for Americans [2,27]. It consists of 12 components: total fruit, whole fruit, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, fatty acids, refined grains, sodium, and empty calories (calories from solid fats, alcohol, and added sugars). With a maximum score of 100, a higher HEI-2010 score reflects closer adherence to the Federal dietary guidelines. Details of the HEI-2010 are available elsewhere [27]. We calculated each NHANES participant's HEI-2010 score on either 24-hour dietary recall day using the MyPyramid Equivalents Database and following the procedures established by the USDA and National Cancer Institute [28–31].

Fast-food and full-service restaurant consumption

NHANES dietary interviews asked about source of each food and/or beverage item consumed on a recall day. Following An (2015) and Powell et al. (2012), fast-food and full-service restaurant consumption are defined as consumption of any food or beverage item on a given day from a fast-food restaurant (fast-food or pizza outlet) or a full-service restaurant (restaurant with waiter/waitress or bar/tavern/lounge) [32,33].

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