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40-Year Trends in Meal and Snack Eating Behaviors of American Adults

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ABSTRACT

Background Understanding changes in profiles of eating behaviors over time may provide insights into contributors to upward trajectories of obesity in the US population. Yet little is known about whether or not characteristics of meal and snack eating behaviors reported by adult Americans have changed over time.

Objective To examine time trends in the distribution of day's intake into individual meal and snack behaviors and related attributes in the US adult population.

Design The study was observational with cross-sectional data from national surveys fielded over 40 years.

Participants/setting Nationally representative dietary data from nine National Health and Nutrition Examination Surveys conducted from 1971-1974 to 2009-2010 (N=62,298 participants aged 20-74 years) were used to describe eating behaviors.

Outcomes examined The respondent-labeled eating behaviors examined included main meals (breakfast, lunch, and dinner), and snacks (before breakfast, between breakfast and lunch, between lunch and dinner, after dinner, or other). For each eating behavior, percent of reporters, relative contribution to 24-hour energy intake, the clock time of report, and intermeal/snack intervals were examined.

Statistical analysis Multivariable logistic and linear regression methods for analysis of complex survey data adjusted for characteristics of respondents in each survey.

Results Over the 40-year span examined reports of each individual named main meal (or all three main meals) declined, but reports of only two out of three meals or the same meal more than once increased; the percentage of 24-hour energy from snacks reported between lunch and dinner or snacks that displaced meals increased; clock times of breakfast and lunch were later, and intervals between dinner and after-dinner snack were shorter. Changes in several snack reporting behaviors (eg, report of any snack or $\geq$2 snacks), were significant in women only.

Conclusions Several meal and snack eating behaviors of American adults changed over time, with a greater change in snack behaviors of women relative to men.
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EVIDENCE FROM CONTROLLED LABORATORY FEEDING trials suggests that biological imperatives that reportedly regulate food and beverage intake in response to hunger and thirst have limited influence on energy balance.[1,2] The available national data on secular trajectories of increasing adiposity[3,4] and self-reported dietary exposures such as large portion sizes, away-from-home eating, snacking, and sweetened beverage consumption[5-12] also point to relative inadequacy of known biological mechanisms for regulation of food intake within the larger socioecologic context of the food environment. Market response to increasing numbers of women in the labor force, changes in family structures, and technology is seen in expansion of available venues for food purchasing and consumption.[13-17] Over time, changes in the food environment have been accompanied by a degree of laxity in traditional social norms about when, where, and how much food may be consumed. There is also evidence of changing norms about what is the self-perceived "just right" body weight.[18] Consequently, it is reasonable to expect that the combined effect of these changes may be reflected in eating behavior patterns that may in turn relate to energy intake.

No accepted definition of "eating behavior" is available in the published literature. In our report, the term *eating behavior* is used to describe the characteristics of named eating episodes in a 24-hour eating period. With sufficient knowledge and forethought, most eating behavior patterns are compatible with selection of nutritionally adequate diets of moderate energy content. Although the US Department of Agriculture (USDA) issued sample menus with the Food Guide Pyramid and the MyPlate recommendations include

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three main meals and one or more snacks,[19,20] none of the Dietary Guidelines for Americans issued before 2010 have included specific recommendations for meal and snack eating behaviors. The 2010 Dietary Guidelines for Americans committee recommendations for meal/snack behaviors in relation to energy balance were limited to a recommendation to eat a nutrient-dense breakfast and an eating frequency that does not promote higher energy intake.[21] Despite the lack of explicit guidance on recommended distribution of day's intake into eating events, free-living individuals usually consume food in discrete bouts with commonly used labels to describe the eating episodes. Examination of these eating behaviors beyond overall frequency of eating meals and snacks provides information about distribution of eating throughout the day. Such information is necessary to understand which individual eating events are susceptible to change over time within the context of other eating events reported in the eating period. For example, change in one behavior may also be linked to a compensatory change in other behaviors. Finally, an examination of secular changes in time of eating and intervals between eating episodes provides information about changes in the possible role of environmental cues for initiation of eating events. However, few published reports have taken this approach to understand changing eating behaviors of the American population.

To extend previous work on this subject,[8] we examined secular trends in (1) reporting of individual main meals (breakfast, lunch, and dinner or equivalents) and intermeal ingestive episodes (called snacks hereafter) and their relative contribution to daily energy intake, and (2) time of reporting and intervals between respondent-named main meals and adjacent snacks.

METHODS

Data Source

Public domain data from nine cross-sectional National Health and Nutrition Examination Surveys (NHANES) conducted from 1971-1974, 1976-1980, 1988-1994, 1999-2000, 2001-2002, 2003-2004, 2005-2006, 2007-2008, and 2009-2010 were used for this observational study. The documentation and data for each of these surveys can be downloaded from the NHANES website.[22] Each NHANES is a multistage, stratified sample of the US population and is conducted by the National Center for Health Statistics of the Centers for Disease Control and Prevention. Each survey collected information via an at-home interview and during a visit to a specially equipped mobile examination center (MEC). Dietary information was collected in MECs. Over time, data collection methods have evolved from paper-and-pencil methods to automated, computer-assisted methods. The unweighted response rate for the MEC-examined sample in each survey was >70%.[23] This study was approved by the City University of New York Human Subjects Protection Committee with an exempt review.

Dietary Assessment Methods

In all surveys, a trained dietary interviewer used a standardized protocol to administer a 24-hour recall of foods and beverages.[22] The 1971-1974 and 1976-1980 surveys used paper and pencil to collect dietary information; however, all subsequent surveys used computer-assisted methods. One in-person dietary recall was collected in 1971-1974, 1976-1980, 1988-1994, 1999-2000, and 2001 surveys. For 2002 and later surveys, a second recall was collected, via telephone, 3 to 10 days after the MEC visit. This study used the first recall for all surveys.

Information on Covariates

Information on all covariates except body weight and height, used to compute the body mass index (calculated as kg/m^2), was self-reported during the household interview.

Analytic Sample

In each survey, all respondents aged 20 to 74 years with a reliable 24-hour dietary recall were eligible (n=64,410) for inclusion in the study. The National Center for Health Statistics determined the reliability of a recall by evaluation of its quality and completeness.[22] The upper age limit of 74 years was necessary because the 1971-1974 and 1976-1980 surveys did not sample respondents older than 74 years of age. Pregnant and lactating women (n=2,106), and those reporting 0 kcal (n=6) in a recall considered reliable by the National Center for Health Statistics were excluded for a final analytic sample of 62,298 respondents.

Eating Behavior Outcomes Examined

During the 24-hour recall interview, respondents were asked to report the clock time when a food or beverage was consumed.[22] For every food or beverage item recalled, respondents also chose a name of the eating event from a list. All items reported in an event were given the same clock time and event name in the recall. In the 1971-1974 and 1976-1980 surveys, respondents could choose from "morning," "noon," "between meal," "afternoon," and "total day" as names of eating events. In all subsequent surveys, the choices for eating event names were changed to commonly used names; for example, "breakfast," "lunch," "dinner," "supper," "snack," "drink," or "extended consumption" and their equivalents in Spanish language. From these data, several meal- or non–meal-associated variables were created for each respondent as described below. In every case, decisions about consideration of eating events as meals or snacks were based on the event label used by the respondent to describe the event.

Main Meal and Snack Outcome Variables. Reports of breakfast, brunch, lunch, supper, and dinner or their equivalents in Spanish were considered as main meals in our study. Report of consumption of morning meal, breakfast, *desayuno*, or *almuerzo* was considered breakfast. Mention of events named noon meal, lunch, brunch, or *comida* was considered report of lunch, and mention of events named afternoon meal, dinner, supper, or *cena* was considered report of dinner. All other eating events were considered as snack. Beginning with the 2005-2006 surveys the 24-hour dietary recall collected information on plain water intake as part of the dietary recall. However, surveys before 2005-2006 did not ask respondents to include plain water intake in the recall. Therefore, for consistency, when the only reported item in a named eating event was plain tap or bottled water (which occurred in 2005-2010 surveys), it was not considered an event regardless of how the event was named by the respondent. All foods and beverages reported at one discrete clock time were considered as part of one eating event.