



Nutrient Intake, Diet Quality, and Weight/Adiposity Parameters in Breakfast Patterns Compared with No Breakfast in Adults: National Health and Nutrition Examination Survey 2001-2008



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ABSTRACT

Background The effect of different breakfast consumption patterns on nutrient intake, diet quality, and weight/adiposity status is unknown.

Objective To compare nutrient intake, diet quality, and weight/adiposity measures of consumers assigned to different breakfast patterns with breakfast skippers.

Design and participants These associations were assessed in adults 19+ years (N=18,988) participating in the 2001-2008 National Health and Nutrition Examination Survey. Intake was determined from 1-day 24-hour dietary recall. Diet quality was quantified using the Healthy Eating Index-2005. Body mass index (calculated as kg/m²) and waist circumferences were determined. Twelve patterns (including No Breakfast [approximately 19% of population]), explaining 58% of the variance in energy from the breakfast meal, were examined. Covariate adjusted general linear models were used to compare nutrient intakes, Healthy Eating Index-2005 scores, and body mass index/waist circumference of consumers of different patterns with breakfast skippers. The *P* value was Bonferroni corrected (<0.05/12 breakfast patterns <0.0042).

Results Consumers of the Grain/100% Fruit Juice and Presweetened Ready-to-Eat Cereal (RTEC)/Lower-Fat Milk patterns had lower daily intakes of nutrients to limit (added sugars, saturated fatty acids, solid fats, cholesterol, and sodium) than breakfast skippers. Consumers of the Grain/100% Fruit Juice; Presweetened RTEC/Lower-Fat Milk; and RTEC/Lower-Fat Milk/Whole Fruit/100% Fruit Juice patterns had higher daily intakes of all shortfall nutrients examined (dietary fiber; vitamins A, D, and C; calcium, potassium, folate, iron, and magnesium) than breakfast skippers. Consumers of the Grain/100% Fruit Juice; Grain; Presweetened RTEC/Lower-Fat Milk; RTEC/Lower-Fat Milk/Whole Fruit/100% Fruit Juice; Cooked Cereal; Lower-Fat Milk/Whole Fruit; and Whole Fruit patterns had higher Healthy Eating Index-2005 scores than breakfast skippers. Consumers of the Grain/100% Fruit Juice; Presweetened RTEC/Lower-Fat Milk; RTEC/Lower-Fat Milk/Whole Fruit/100% Fruit Juice; and Cooked Cereal patterns had lower body mass indexes and waist circumferences than breakfast skippers.

Conclusions Results suggest dietary and weight advantages of consuming breakfast, especially ones that include grains, cereals, lower-fat milk, and whole fruit/100% fruit juice, in contrast to the potential adverse effects of skipping breakfast.

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TRADITIONALLY, BREAKFAST HAS BEEN CONSIDERED the most important meal of the day. Studies in adults have shown that consuming breakfast improves daily nutrient intake,¹⁻⁶ food group selection,^{4,5,7,8} dietary adequacy,^{2,9} and diet quality.^{1,8,10,11} In general, breakfast consumption has also been associated with positive measures of body mass index (BMI),^{7,10-13} other adiposity parameters,^{7,10,12} and cardiovascular risk factors^{8,13-18}; however, the literature is inconsistent.¹⁹

Adult breakfast consumers have been shown to have higher intakes of many nutrients, especially micronutrients,^{1,2,4} than

breakfast skippers. A study by Nicklas and colleagues² showed that young adults participating in the Bogalusa Heart Study that consumed breakfast had lower total daily intakes of energy, protein, and saturated fatty acids (SFA) when compared with breakfast skippers. These results were confirmed and extended in a study using data from the National Health and Nutrition Examination Survey (NHANES) 1999-2002 comparing nutrient intake of young adults consuming ready-to-eat cereal (RTEC) breakfasts, "other breakfasts," or no breakfast. Those consuming RTEC or "other breakfasts" had higher intakes of dietary fiber, vitamins A and B-12, thiamin, riboflavin, folate, calcium, phosphorus, magnesium, and potassium than breakfast skippers.¹ In addition, those consuming RTEC breakfasts had higher intakes of vitamins C and B-6, niacin, iron, and zinc than breakfast skippers. Although that study listed some of the foods found in the "other breakfasts," no attempt was made to link specific breakfast foods or breakfast meal patterns with dietary intake. Higher intakes of micronutrients may have been the result of the nearly universal vitamin and mineral fortification of RTEC.

Consumption of a breakfast meal has also been associated with improved weight/adiposity measures in adults. Song and colleagues¹² showed that breakfast consumption was associated with a lower prevalence of overweight and obesity, but that the type of breakfast mattered and that there were sex differences. When RTEC and other breakfast consumers were compared with breakfast skippers, RTEC consumers weighed less than other breakfast consumers or breakfast skippers.¹ Data from the Coronary Artery Risk Development in Young Adults study showed that hazard ratios in those consuming breakfast daily breakfast were lower for obesity and abdominal obesity.¹³

Despite these health benefits, the breakfast meal is frequently skipped. Breakfast skipping in adults is age-dependent. Data from the most recent *What We Eat in America*²⁰ tables have shown that 28% of males and 22% of females 20 to 29 years of age skipped breakfast, and the prevalence of skipping breakfast declined with age, until by 70+ years only 5% of males and 4% of females did not consume a breakfast meal.

The purposes of this study were to identify breakfast patterns consumed by a nationally representative sample of adults and to determine association of the breakfast patterns to the total daily nutrient intake and diet quality of consumers of these patterns vs breakfast skippers (No Breakfast pattern). Weight and adiposity measures were also compared from those consuming different breakfast patterns with breakfast skippers.

METHODS

NHANES

NHANES is a continuous surveillance program designed to collect nationally representative information on the nutrition and health status of the civilian, noninstitutionalized US population. Conducted by the National Center for Health Statistics, data are collected using a complex, stratified, multistage probability cluster sampling design. Survey data are collected via an in-home interview for demographic and basic health information, and a comprehensive health examination is conducted in a mobile examination center.

Detailed descriptions of the sample design, interview procedures, and physical examinations conducted are available online.²¹ These descriptions include the response rates of the survey release cycles, which vary by cycle, sex, and age.²²

Study Participants

Data from adults (N=18,988) 19+ years old participating in the 2001-2002, 2003-2004, 2005-2006, and 2007-2008 NHANES were combined to increase sample size.²³ Analyses included only individuals with reliable dietary records; females who were pregnant or lactating were excluded from analyses. NHANES has stringent protocols and procedures that ensure confidentiality and protect individual participants from identification using federal laws.²⁴ This was a secondary data analysis that lacked personal identifiers; therefore, this study did not require institutional review.²⁵

DEMOGRAPHICS AND DIETARY INFORMATION

Demographic information was obtained by interview.²⁶ Intake data were obtained from *What We Eat in America* which used in-person 24-hour dietary recall interviews administered using an automated multiple-pass method.^{27,28} A single 24-hour dietary recall was collected from each participant in 2001-2002; however, beginning in 2003-2004, two days of intake were collected. To ensure consistency, only the data from the in-person interview (first recall or Day 1) were used for this study. Detailed descriptions of the dietary interview methods are available.²⁹

BREAKFAST, FOOD GROUPINGS, AND NUTRIENT ANALYSIS

Breakfast meals were self-reported and included consumption of any food/beverage other than water, at the meal reported by the study population as breakfast/brunch (*desayuno/almuerzo* in Spanish). The US Department of Agriculture (USDA) Food and Nutrient Database for Dietary Studies³⁰ (FNDDS) food groups were combined into 20 breakfast food groupings (Table 1). All food codes fit into only one of the food groups. Food group equivalent intakes were determined using MyPyramid Equivalents Database, versions 1.0³¹ and 2.0³²; when necessary, intakes for 2005-2008 NHANES were hand matched to similar foods because there were no MyPyramid Equivalents Databases released during that time. There is no consistent definition of a presweetened RTEC; however, for the purposes of this study, an RTEC was classified as a presweetened RTEC if the reference amount customarily consumed contained ≥ 6 g sugar.³³ The Food and Drug Administration definition for 100% fruit juice was used.³⁴ Added sugars were defined, using the USDA definition,³⁵ as any caloric sweeteners eaten separately or used as ingredients in processed or prepared foods. Lower-fat milk was defined as all fluid milk other than whole milk.

Energy and nutrient intakes were calculated using the FNDDS (versions 1.0-4.0)³⁰ for NHANES 2001-2002, 2003-2004, 2005-2006, and 2007-2008, respectively. The vitamin D content of foods was determined from the Vitamin D Addendum to USDA FNDDS 3.0³⁶; this database was also used to hand match similar foods to determine vitamin D content of foods in previous FNDDS releases. The nutrients studied reflect the nutrients to limit, nutrients of public health

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