RESEARCH
Original Research

Added Sugars Intake Across the Distribution of US Children and Adult Consumers: 1977-2012

Elyse S. Powell; Lindsey P. Smith-Taillie, PhD; Barry M. Popkin, PhD

ARTICLE INFORMATION

Article history:
Submitted 1 October 2015
Accepted 2 June 2016
Available online 1 August 2016

Keywords:
Added sugars
Trends in intake
Distribution of consumers
Children
Adults

Supplementary materials:
Table 3 is available at www.andjrnl.org

http://dx.doi.org/10.1016/j.jand.2016.06.003

ABSTRACT

Background Public health organizations in the United States have recently increased focus on reducing population consumption of added sugars.

Objective The objective of this study is to provide in-depth information on national trends in added sugars consumption and to examine both the mean and distribution of added sugars intake from 1977 to 2012.

Design We conducted a descriptive study using six cross-sectional nationally representative surveys of food intake in the United States: the 1977-1978 National Food Consumption Survey (n=29,668), the 1989-1991 Continuing Survey of Food Intake by Individuals (n=14,827), the 1994-1998 Continuing Survey of Food Intake by Individuals (n=19,027), the 2003-2004 National Health and Nutrition Examination Survey (NHANES; n=8,273), the 2009-2010 NHANES (n=9,042), and the 2011-2012 NHANES (n=16,451).

Statistical analysis We examined the key dependent variables, calories from added sugars and percentage of total energy intake from added sugars, at the mean and by quintiles of added sugars consumption for children (2 to 18 years) and adults (19 years and older) across the survey years. We also examined trends in added sugars intakes from foods and beverages. We used ordinary least squares regression to examine linear trends between survey years and multinomial logistic regressions to examine sociodemographic characteristics by quintile of added sugars consumption. We adjusted estimates by race, income, sex, and education.

Results The US mean adjusted intake of added sugars remains high. In 2011-2012, children and adults consumed 326 kcal/day and 308 kcal/day, respectively, of added sugars, or 14% and 17%, respectively, of total their energy. For both children and adults, there was a considerable increase in calories from added sugars from 1977 to 2003, followed by a substantial decline from 2003 to 2012. There was no decline in the percentage of total energy intake from added sugars from 2003 to 2012. Changes over time were consistent across each quintile of added sugars consumption. The highest quintile of consumption was more likely to be male and in children was more likely to be non-Hispanic white.

Conclusions Despite a decline in consumption of added sugars since 2003 in the United States, mean adjusted added sugars intakes continue to be above the recommended level of 10% of the total energy intake. Changes in added sugars consumption from 1977 through 2012 occurred evenly across the distribution of added sugars intakes.
J Acad Nutr Diet. 2016;116:1543-1550.

OVERCONSUMPTION OF ADDED SUGARS IS AN important public health concern. Added sugars are those added during food processing or preparation, as opposed to intrinsically occurring sugars such as fructose in fruit or lactose in milk. Consumption of added sugars is associated with reduced diet quality, increased energy intake, cardiovascular disease mortality, and dental caries.[1-3] Consequently, reducing intake of added sugars has long been a target of public health organizations.[4,5]

Reducing added sugars consumption has recently attracted greater attention in the United States. In February 2015, the Dietary Guidelines Advisory Committee released for public commentary a recommended limit of 10% of daily energy intake from added sugars.[6] In 2015, the US Food and Drug Administration proposed a new rule requiring the inclusion of added sugars on the Nutrition Facts label in an effort to both reduce added sugars consumption and encourage manufacturers to add less sugar to foods.[7] The World Health

Organization recently made a conditional recommendation to lower added sugars intake to 5% of total energy intake from the previously recommended limit of 10%.

Despite these recent efforts, there is a lack of studies examining more recent shifts in the US population's consumption of added sugars. From 1977 through 2000, added sugars contributed a growing proportion of calories to the US diet.[8,9] However, after decades of increases, total added sugars consumption declined from 1999 through 2008 for both children and adults.[9] Yet it has been unclear whether these downward trends have continued or leveled off.[10]

There is also little research into how consumption of added sugars from food vs beverage sources have changed, particularly in recent years. Previous research and policy efforts have focused on added sugars from beverages due to their substantial contribution to total added sugars intake and because additional calories from beverages are not compensated for by reduced food intake, leading to increased overall energy intake.[11-13] Between 2000 and 2008, much of the reduction in calories from added sugars came from a reduction in consumption of added sugars from beverages.[9] But it is unclear how consumption of calories from added sugars in foods has changed. Since 1999, there have been decreases in consumption of some foods that are the largest contributors to added sugars intake, such as ready-to-eat cereals, but little change in others, such as grain-based desserts and candy.[9,14]

Previous analyses of trends in intake of added sugars have focused on mean intake, which misses the potentially wide distribution of such consumption.[15] Examining changes across the distribution of added sugars intake can identify whether trends have occurred evenly across the population, or whether some segments of the population are changing less. For example, it is important to identify whether declines in mean consumption are driven by decreases only among the lowest consumers, while the highest consumers fail to reduce intake. Further, examining the distribution of added sugars intake can identify the highest-consuming segment of the population. One study found that among adults, the highest quintile of added sugars consumption is associated with a hazard of cardiovascular disease mortality 2.43 (95% CI 1.63 to 3.62) times higher than that of the lowest quintile of consumption.[2] Understanding whether sociodemographic disparities in mean added sugars intake persist among the highest consumers can help identify those with the greatest health risks.

The purpose of this study was to provide knowledge about national consumption of added sugars in the United States through an in-depth exploration of trends using six nationally representative surveys of food intake. Specifically, our objectives were to (1) examine whether declines in added sugars intake in the early 2000s continued through 2011-2012, (2) investigate the respective contributions of added sugars from foods and beverages, (3) document shifts in added sugars intake across the distribution of consumption, and (4) find out which sociodemographic characteristics are associated with the highest-added sugars consumers.

METHODS

Participants

This descriptive study used cross-sectional data on children and adults aged 2 years and older from six nationally representative surveys of food intake in the United States: the 1977-1978 National Food Consumption Survey (n=29,668), the 1989-1991 Continuing Survey of Food Intake by Individuals (CSFII; n=14,827), the 1994-1998 CSFII (n=19,027), the 2003-2004 National Health and Nutrition Examination Survey (NHANES; n=8,273), the 2009-2010 NHANES (n=9,042), and the 2011–2012 NHANES (n=16,451). All of the surveys used a complex multistage, stratified sampling of the US noninstitutionalized civilian population, which has been described in detail elsewhere.[16-19]

Dietary Data

Detailed methodology on US national nutrition surveys has been reported elsewhere.[16-19] Interviewer administered 24-hour recalls were used to collect data on food and beverage type and quantity. The 1977-1978 National Food Consumption Survey and the 1989-1991 CSFII collected one in-home, interviewer-administered 24-hour recall and one self-administered 24-hour recall on 2 consecutive days. The 1994-1998 CSFII, the 2003-2004 NHANES, the 2009-2010 NHANES, and the 2011-2012 NHANES collected 2 nonconsecutive 24-hour recalls conducted by trained interviewers. The first day was collected in person, and the second day was collected either in person (CSFII) or by phone (NHANES). To maximize comparability between surveys, we used only the first 24-hour recall in this analysis. For NHANES, a proxy respondent completed recalls for children 6 years and younger, and recalls for children 6 to 11 years were proxy assisted. For the CSFII, the main meal planner/preparer in a household reported for children 11 years old and younger.

We recorded dietary intake data using discrete food codes and linked them to food composition databases that reflect the foods available at the time of the survey. All databases are based on the USDA National Nutrient Database for Standard Reference.[20] The University of North Carolina Institutional Review Board deemed this study exempt.

Energy from Added Sugars

We used the USDA's MyPyramid Equivalents Database (MPED) to examine consumption of added sugars. The USDA defines added sugars as all sugars used as ingredients in processed and prepared foods and does not include naturally occurring sugars, such as fructose in fruit or lactose in milk, unless the sugar is added to the food item. A list of sugars included in the database as added sugars is publically available.[21] The USDA also does not include sugars from fruit juice concentrates as added sugars.[22]

We used MPED 1.0 for 1994-1998 CSFII, MPED 2.0 for 2003-2004 NHANES, the Food Patterns Equivalents Database (FPED) for 2009-2010 NHANES, and the FPED 2.0 for 2011-2012 NHANES. There is no MPED for the 1977-1978 National Food Consumption Survey or the 1989-1991 CSFII, so we matched the food codes in those surveys to the food codes in the 1999-2004 NHANES and used the MPED values from the oldest available year. In the infrequent cases when we could not make a direct match, we imputed MPED values using the following method. We categorized foods according to University of North Carolina food groups. We then divided each food group into three subsets: no added sugar, below the mean of added sugars in that food group, and at or above the mean of added sugars in that food group. We imputed the food code with the missing value to have the average amount