

Citation:

Ludwig DS, Peterson KE, Gortmaker SL. Relation between consumption of sugar-sweetened drinks and childhood obesity. *Lancet* 2001;357:505-8.

PubMed ID: [11229668](#)

Study Design:

Prospective Cohort Study

Class:

B - [Click here](#) for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To examine the relation between the rising prevalence of obesity in children and the consumption of sugar-sweetened drinks.

Inclusion Criteria:

Part of the Planet Health intervention and evaluation project, which took place in schools in four communities in the Boston, Massachusetts, metropolitan area between October, 1995, and May, 1997.

Children from five randomly assigned control schools took part.

Exclusion Criteria:

Children who changed schools as baseline, in special ed classes, in grades other than 6th or 7th, or did not complete English-language version of questionnaire

Description of Study Protocol:**Diet**

Measures of dietary intake, physical activity, and television viewing were obtained with a student food and activity questionnaire administered in class under the supervision of trained teachers.

An adapted and validated form of the youth food-frequency questionnaire (YFFQ) was used to assess average intake of drinks, percentage energy intake from dietary fat, and total energy intake. Sugar-sweetened drink consumption was calculated from responses to the YFFQ.

Physical Activity

Physical activity was assessed with the youth activity questionnaire (YAQ).

Television and Video

Time spent watching television and videos was measured with the 11-item television and video measure (TVM).

Anthropometrics and Sexual Maturity

Baseline self-reports of menarcheal status was obtained for girls.

Height and weight were measured.

Data Collection Summary:

Recruited from 5 public schools randomly assigned to control schools in Planet Health intervention to reduce obesity

Duration:

19 months (Oct. 1995-May 1997; 2 academic years)

Location: 4 Boston, Massachusetts communities

Statistical analyses:

- Multivariate generalized estimating equation (GEE) models
- (controlled for numerous variables did not change results)

Variables

Independent:

- Sugar-sweetened: 1) soda, 2) Hawaiian punch/lemonade/Koolaid or other sweetened fruit drink, iced tea not artificially sweetened, 100% fruit juice (apple, orange & other) (youth FFQ on past 30 days administered to students in class under supervision of teacher with 1-hr training)

Dependent:

- BMI (measured height & weight)
- Obesity: BMI & TSF \geq 85th percentile (reference data – Must, AJCN 1991)

Confounding:

- baseline anthropometrics (BMI & TSF), demographics (age, gender, ethnicity), school indicator, diet variables (% fat at baseline, energy-adjusted fruit juice & sweetened beverages at baseline, change in these variables), physical activity, TV/video time; adding menarcheal age

Description of Actual Data Sample:

Sample: 263 females, 285 males

Age: mean 11.7 years at baseline

Ethnicity: 64% white, 14% black, 15% Hispanic, 8% Asian, 8% American Indian/other

SES: Median income in area = US\$34,200 according to 1990 census data; similar to median for U.S.

Summary of Results:

- No association with baseline consumption of sweetened beverages and obesity incidence
- But baseline consumption of sugar-sweetened drinks independently associated with change in BMI (mean 0.18 kg/m² for each daily serving; 95%CI 0.09-0.27; p=0.02)
- For each additional serving of sugar-sweetened drink consumed, both BMI (mean 0.24 kg/m²; 95%CI 0.10-0.29, p =0.03) and frequency of obesity (OR 1.60, 95% CI 1.14-2.24, p=0.02) increased
- Change in diet soda consumption negatively associated with obesity incidence (p=.03, OR .44)
- Note: no separate analysis described for fruit juice consumption

Other Results: (baseline to follow-up; * = significant change, p < 0.01)

- 27% to 28% obese
- 1.2 to 1.4 * daily servings sweetened beverages
- 1.3 to 1.1 daily servings fruit juice

Author Conclusion:

Consumption of sugar-sweetened drinks is associated with obesity in children; consistent with hypothesis that imprecise and incomplete compensation occurs for energy consumed in liquid form.

Reviewer Comments:

Strengths:

- *Measured height & weight*
- *Obesity based on composite indicator*
- *Prospective evaluation*
- *Controlled for numerous potential confounders*

Weaknesses:

- *Low generalizability: convenience sample*

Note: cannot prove cause/effect even though longitudinal because observational

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A
Validity Questions		
1.	Was the research question clearly stated?	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	Was the selection of study subjects/patients free from bias?	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	N/A
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	Were study groups comparable?	N/A
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A

3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	Was method of handling withdrawals described?	Yes
4.1.	Were follow-up methods described and the same for all groups?	N/A
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	Was blinding used to prevent introduction of bias?	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were intervening factors described?	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes

6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	N/A
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	Were outcomes clearly defined and the measurements valid and reliable?	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	Was the statistical analysis appropriate for the study design and type of outcome indicators?	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes

8.7.	If negative findings, was a power calculation reported to address type 2 error?	Yes
9.	Are conclusions supported by results with biases and limitations taken into consideration?	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	Is bias due to study's funding or sponsorship unlikely?	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes

Copyright American Dietetic Association (ADA).