

Citation:

Dubois L, Girard M, Potvin Kent M, Farmer A, Tatone-Tokuda F. Breakfast skipping is associated with differences in meal patterns, macronutrient intakes and overweight among pre-school children. *Public Health Nutrition* 2009;12(1):19-28.

PubMed ID: [18346309](#)

Study Design:

Cross-sectional Study

Class:

D - [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 association between skipping breakfast, daily energy, macronutrients and food intakes, and BMI in pre-school children.
- It was hypothesized that, after controlling for important covariates, pre-school children who ate breakfast on fewer than 7 days per week would also be found to have a lower diet quality and higher prevalence of overweight and obesity in comparison with pre-school children who ate breakfast every day

Inclusion Criteria:

- Pre-school children born in Quebec, Canada in 1998

Exclusion Criteria:

- Twins and children with major diseases or handicaps at birth were excluded from the study

Description of Study Protocol:**Recruitment**

- Data obtained from the Longitudinal Study of Child Development in Quebec (1998 - 2012, LSCDQ), a representative sample of children born in Quebec, Canada in 1998.
- To ensure geographic representation and minimize seasonality effects, children born throughout the year in each public health geographic area of the province were randomly selected

Design: Cross-sectional Study

Blinding used (if applicable): not applicable

Intervention (if applicable): not applicable

Statistical Analysis

- Weighted data, adjusted for within-child variability, were used in the analysis
- Energy, macronutrients, and food servings were analyzed as continuous variables and were square-root transformed whenever normality was not achieved
- Odds ratios estimates, including confidence intervals, were determined through logistic regression analyses
- Adjusted means were calculated by one-way ANOVA

Data Collection Summary:

Timing of Measurements

- Children and their parents were first seen at 5 months (adjusted for gestational age) and subsequently at one year intervals.
- Each testing point involved standardized, questionnaire-based, face-to-face interviews with the person deemed most knowledgeable of the child, generally the mother.
- Analyses presented are based on the fifth data collection

Dependent Variables

- Height, weight, BMI
- Children's height and weight were measured twice by a trained nutritionist following a standardized protocol
- Overweight was defined as having a BMI at or above the 95th percentile on the sex- and age-specific US CDC growth charts (at 4.5 years, a cut-off of 18.1 kg/m² for boys and 17.8 kg/m² for girls) and according to Cole's criteria, which provides age- and sex-specific cutoff points from 2 - 18 years for overweight and obesity (at 4.5 years, a cut-off of 17.19 kg/m² for girls and 17.47 kg/m² for boys)

Independent Variables

- Children's food consumption derived from parent/day-care attendant's responses to 24-hour recall interviews and eating behavior questionnaires
- 24-hour recall instrument was used in the nutrition survey of the Health and Social Survey of Quebec Children and Adolescents, 1999
- Energy and macronutrient composition were evaluated according to the Canadian Nutrient File 2001 and the USDA recipe file
- Meal patterns were categorized into breakfast, lunch, dinner, morning snacks, afternoon snacks, and evening snacks

Control Variables

- Children's sex
- Mother's education level
- Birth weight
- Mother's immigrant status
- Number of parents overweight/obese
- Mother's smoking status

- Inactivity index based on level of physical activity

Description of Actual Data Sample:

Initial N: 2,103 children in original sample. 1,944 remained at 4 years in 2002.

Attrition (final N): 1,549 respondents volunteered to have their child take part in the nutrition component of the study, 51% boys, 49% girls

Age: mean age 49 ± 3.12 months (range 44 to 56 months)

Ethnicity: not reported

Other relevant demographics:

Anthropometrics

Location: Quebec, Canada

Summary of Results:

Key Findings:

- Approximately 8.8% of children were overweight or obese according to the 2000 CDC growth charts, while 14.3% were classified as overweight or obese based on Cole's criteria
- 10% of children ate breakfast on fewer than 7 days per week; this was associated with a lower diet quality and concentrated energy intakes through higher protein intakes at lunch and the consumption of snacks higher in energy and carbohydrate in the afternoon and evening
- Total daily energy intakes were not significantly different from those of pre-school children who are breakfast every day
- Breakfast skippers' mean BMI increased as intake of energy, carbohydrates, or servings of grain products increased; however, this was not the case for breakfast eaters
- The adjusted odds of being overweight at 4 years among pre-school children was double for breakfast skippers compared with those who ate breakfast every day
- When Cole's cut-off for overweight/obesity was used, overweight/obesity in breakfast skippers was related to the dinner-time consumption of approximately 3000 kJ (700 kcal) or more for energy intake, approximately 100 g or more of carbohydrates, or approximately 3 servings or more of grain products

Adjusted Odds Ratios and 95% Confidence Intervals for Breakfast Skippers and Overweight by Daily Consumption of Energy, Macronutrients, and Food Categories

Model 1: Breakfast eating only

Breakfast eaters	1.00
Breakfast skippers	2.00 (1.20, 3.35), P < 0.05

Model 2: Breakfast eating and energy intake

Breakfast eaters	1.00
Breakfast skippers	2.27 (1.34, 3.87), P < 0.05
Energy intake (per 418.4 kJ/100 kcal)	1.22 (1.14, 1.31), P < 0.05

Model 3: Breakfast eating and macronutrient intake

Breakfast eaters	1.00
Breakfast skippers	2.27 (1.33, 3.88), P < 0.05
Carbohydrates (per 10 g)	1.13 (1.07, 1.20), P < 0.05
Total fats (g)	1.01 (0.99, 1.04)
Proteins (g)	1.01 (0.98, 1.03)

Model 4: Breakfast eating and food groups

Breakfast eaters	1.00
Breakfast skippers	2.50 (1.45, 4.31), P < 0.05
Vegetables and fruits (number of servings)	1.06 (0.94, 1.21)
Grain products (number of servings)	2.11 (1.69, 2.64), P < 0.05
Milk products (number of servings)	1.09 (0.83, 1.42)
Meat and alternatives (number of servings)	1.17 (0.83, 1.64)

Other Findings

- In comparison with breakfast eaters, breakfast skippers consumed a lower mean number of servings from vegetables, grain products and milk products

Author Conclusion:

In summary, although the total daily macronutrient composition and energy intakes of breakfast skippers were similar to those of pre-school children who eat breakfast every day, breakfast skippers concentrated their energy intakes through higher protein intakes at lunch and the

consumption of snacks higher in energy and carbohydrate in the afternoon and evening. These associations corresponded with a higher prevalence of overweight and obesity in pre-school children who skipped breakfast. Given that breakfast eating was found to be associated with the more even distribution of energy intake throughout the day, it is possible that breakfast eating may play a role in the maintenance of a normal weight status and improved diet quality. Public health messages targeting parents of young children need to emphasize the importance of developing healthy eating patterns at a young age, by promoting regular breakfast eating and healthy snack choices over energy-dense snacks for pre-school children.

Reviewer Comments:

Large sample size. Authors note the following limitations:

- *Cross-sectional nature of the data*
- *Reverse causality also remains possible if parents of overweight children intentionally try to restrict the child's diet*
- *Self-reported nature of the 24-hour recall data, but this would have affected both breakfast skippers and breakfast eaters*

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?	Yes
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?	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
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?	Yes
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.)	Yes
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?	Yes
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?	N/A
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	N/A
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?	N/A
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?	N/A
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?	N/A
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

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