

Is breakfast intake associated with achieving recommended nutrient intakes?

Conclusion

Moderate evidence supports a positive relationship between the behavior of breakfast consumption and intakes of certain nutrients in children, adolescents and adults.

Grade: Moderate

Overall strength of the available supporting evidence: Strong; Moderate; Limited; Expert Opinion Only; Grade not assignable For additional information regarding how to interpret grades, [click here](#).

Evidence Summary Overview

This conclusion is based on the review of 15 studies published since 2004. Of these 15 studies, one is a systematic review that includes studies with children and adolescents (Rampersaud et al, 2005), while four original studies include only adults (Kerver et al, 2006; Song et al, 2005; van der Heijden et al, 2007; Williams, 2005), nine evaluate children or adolescents (Affenito et al, 2005; Dubois et al, 2008; Matthys et al, 2007; Nelson et al, 2007; Stockman et al, 2004; Timlin et al, 2009; Williams et al, 2007; Williams et al, 2009; Woodruff et al, 2008) and one includes adolescents and adults (Song et al, 2006). Not all nutrients are evaluated in all studies. However, in those studies in which selected micronutrients are examined, individuals who consume breakfast on a daily basis consistently have higher intakes of thiamin, niacin, riboflavin, vitamins B₆ and B₁₂, dietary folate, vitamins A and C, calcium, iron, magnesium, phosphorus, potassium and zinc. In studies that include dietary fiber, breakfast intake is associated with higher intakes. An equal number of studies show that breakfast consumers have higher, lower, or no difference in total fat, saturated fat, cholesterol and sodium intakes compared to non-consumers of breakfast.

Evidence Summary Paragraphs

Affenito et al, 2005 (positive quality), conducted a longitudinal cohort study to examine the association of breakfast intake with dietary calcium, fiber and body mass index (BMI). The study used data (1,166 white and 1,213 African-Americans aged nine or 10 years at baseline) from the National Heart, Lung and Blood Institute (NHLBI) Growth and Health Study, a nine-year, longitudinal cohort with annual three-day food records. Generalized estimation equations methodology (adjusting for effects of site, age, race, parental education, physical activity and total energy intake) was used to examine differences in frequency of breakfast eating by age and race. The number of days breakfast was eaten tended to decrease with increasing age. Approximately 77% of white girls and 57% of African-American girls eat breakfast on all three days, compared with 32% and 22%, respectively, by age 19. White girls reported greater frequency of breakfast consumption than African-American girls did ($X^2[1]=203.42$, $P<0.0001$) on all three days and the racial difference decreased with increasing age. Frequency of breakfast eating was found to be significantly associated with calcium intake ($X^2[3]=81.29$, $P<0.0001$). Number of days eating breakfast was significantly associated with an increase in fiber intake ($X^2[3]=86.53$, $P<0.001$), with the greatest difference (adjusted estimate of 1.13g.) between girls who ate breakfast all three days and those who reported no breakfast eating. In conclusion, days eating breakfast were associated with higher calcium and fiber intake, regardless if adjustment variables.

Dubois et al, 2008 (positive quality), used cross-sectional data from the Longitudinal Study of Child Development in Quebec (1998-2012) (LSCDQ) to examine the association between skipping breakfast, daily energy, macronutrients and food intakes and BMI in 1,549 Canadian pre-school children, aged 49 (SD 3.12) months old. Food consumption and anthropometric measurements were derived from parent or day-care attendant's responses to 24-hour recall interviews and eating behavior questionnaires. Ten percent of children ate breakfast on fewer than seven days per week. Total daily energy and nutrients intakes were not significantly different from those of pre-school children who ate breakfast every day, except for protein intake (55.8g for breakfast skippers and 58.7g for breakfast eaters; $P<0.05$). Overall it was observed that eating breakfast every day was associated with having a more even distribution of energy intake across meals throughout the day.

Kerver et al, 2006 (positive quality), used cross-sectional data from the Third National Health and Nutrition Examination (NHANES) survey to test the hypothesis that specific meal and snack patterns are associated with selected nutrient intakes. Subjects in this study were 15,978 US adults 20 years and older who self-reported meals or snacks. For this analysis, meals reported as breakfast and brunch were collapsed into the breakfast group. Subjects were divided into categories of daily eating frequency (one to two, three, four, five and at least six), based on the sample distribution and 17.7% of the population reported skipping breakfast. After adjusting for sex, ethnicity, alcohol intake, vitamins, minerals, BMI, physical activity and income, the breakfast skippers group (which consumed only lunch, dinner and two snacks), when compared with the breakfast, lunch and dinner group, had lower intakes of all micronutrients analyzed (vitamin B₆ 1.83±0.04mg; folic acid 252±97.29µg; vitamin C 97.6±4.19mg; calcium 818±26.8mg; magnesium 310±5.79mg; iron 14.5±0.25mg; potassium 2,995±67.4mg; and dietary fiber 16.8±0.37g.) except sodium (3,810±66.5mg) ($P<0.0001$).

Matthys et al, 2007 (positive quality), analyzed data from a cross-sectional survey to describe breakfast consumption patterns. A total of 341 adolescents (13-18 years old), selected from all educational levels in the Belgian secondary school system, completed a seven-day food record. Qualitative and quantitative aspects of breakfast were combined into a so-called "individual breakfast score" on the basis of food groups present in the breakfast and the amount of energy. Overall, the individual breakfast score was less than three (i.e., never eat or usually do not eat breakfast). In both boys and girls, the energy intake and the proportional contribution of proteins were significantly higher in subjects having a good-quality breakfast, score of 5 ($P=0.022$ and <0.001 respectively). Girls who consumed a good-quality breakfast had a significantly higher proportional intake of polysaccharides than the low-quality breakfast consumers ($P=0.002$). In both boys and girls, the intake at breakfast of the selected micronutrients (calcium, phosphorus, iron, magnesium, thiamin, riboflavin, vitamin C) was significantly higher in subjects consuming a good-quality breakfast ($P<0.001$ for all micronutrients). Both male and female adolescents who consumed a good-quality breakfast had significantly higher intakes of bread, fruit, vegetables, milk and milk products, and fruit juice, while their intake of soft drinks was significantly lower than those who consumed a low-quality breakfast. Female good-quality breakfast consumers also had significantly higher intakes of cereal products, cheese and water. In conclusion, the consumer of a good-quality breakfast has a better overall dietary pattern on a nutrient and food-group level, than the consumer of a low-quality breakfast. Note: No adjustments for confounders were mentioned.

Nelson et al, 2007 (positive quality), in a cross-sectional study undertook secondary analysis of the 1997 National Diet and Nutrition Survey of Young People aged four to 18 years in order to describe the contribution of school meals to daily food and nutrient intakes and to compare the findings with data collected in English primary and secondary schools in 2004-2005. Seven-day food consumption data according to age, sex, household income, free school meals and breakfast consumption for 1,456 school children (743 primary- and 713 secondary-school pupils) were evaluated. Sixty-two percent of pupils reported having breakfast with cereal, 29% had breakfast without cereal and overall 9% had no breakfast. The percentage not reporting breakfast was lowest in primary-school boys (4%) and girls (5%), and the highest was in secondary-school boys (9%)

and girls (25%). Nutrient intakes of pupils who did not have breakfast were significantly lower than of those who did have breakfast, whether or not cereal was included (data were not available). However, the contribution to daily nutrient intakes from school meals was highest in those who had not had breakfast, intermediate in those who had breakfast without cereal and lowest in those who had breakfast with cereal.

Rampersaud et al, 2005 (neutral quality), in a systematic review evaluated 47 studies examining the association of breakfast consumption with nutritional adequacy (nine studies), body weight (16 studies) and academic performance (22 studies) in children and in adolescents. Although the quality of breakfast was variable within and between studies, children who reported eating breakfast on a consistent basis tended to have superior nutritional profiles than their breakfast-skipping peers. Breakfast eaters generally consumed more daily calories yet were less likely to be overweight, but not all studies associated breakfast skipping with overweight. Two studies reported that children and adolescents skipped breakfast more than any other meal. The breakfast-skipping prevalence reported in three other studies ranged from 12% to 34%. Six studies showed that breakfast eaters tended to have a higher total daily intake of energy compared with breakfast skippers, suggesting that skippers did not consume more calories at other meals to compensate for the deficit. Correspondingly, breakfast eaters tended to have higher daily intakes of total carbohydrate (CHO) (from two studies), total protein (from six studies), total fat (from two studies) and saturated fat (from one study). Four studies showed that fiber intake was significantly higher in breakfast eaters vs. skippers and the inclusion of a ready-to-eat cereal seemed to contribute to daily fiber intake. Associations of breakfast habits on serum lipids have been inconsistent. Breakfast eaters have higher daily intakes of micronutrients and are more likely to meet nutrient intake recommendations compared with breakfast skippers. Nutrients that seemed to be particularly affected across a variety of studies and population groups include vitamins A and C, riboflavin, calcium, zinc and iron. Data related to the effects of breakfast on micronutrient status (i.e., blood or tissue concentrations) are not widely reported except with regard to ready-to-eat cereal (RTEC) consumption. Seven studies showed that children and adolescents who skipped breakfast did not, on average, make up the nutrient deficits at other meals during the day, which has also been observed in adults (from two studies). The data from one population-based survey indicate that children and adolescents tend to have similar nutrient intakes from daily meals other than breakfast, regardless of whether they skip or consume breakfast. The same study mentioned that female adolescents who skipped breakfast had lower intakes of nutrients at other meals compared with female adolescent breakfast consumers. Several studies showed that the inclusion of RTEC and milk enhance calcium and iron intake.

Song WO et al, 2005 (positive quality), used cross-sectional data to test the hypothesis that breakfast consumption is associated with weight status measure by BMI, using data from the NHANES 1999-2000. Survey participants are breakfast consumers who reported consuming a meal they identified as breakfast. Also, dietary recalls were used to estimate daily intake of total energy, fiber, fat, CHO and protein with reference of the US Department of Agriculture (USDA) Survey Database. Data from men and women ≥ 19 years (N=4,218) were evaluated using multiple logistic and linear regression models, with controls for covariates (age, sex, ethnicity, smoking habits and energy intake). Breakfast consumers were more likely than breakfast non-consumers to be older, female, white, non-smokers, regular exercisers (9.7% vs. 6.1%; $P < 0.001$) and trying to control their weight (10.8% vs. 6.3%; $P < 0.01$). Seventy-seven percent of adults consumed breakfast in one given day with significant difference between the sexes (74.7% men vs. 79.4% women [$P < 0.05$]). Rate of breakfast consumption increased with age from 62.8% among 19- to 29-year-olds to 92.5% among participants aged 70 years old and older. The percent of breakfast consumption was highest among whites (80.4%), compared with 68.7% for African-Americans and 71.7% for Hispanics. Energy intake from fat was not significantly different between breakfast consumers and non-consumers (33% vs. 32%). Among men and women, breakfast consumers had significantly higher daily dietary fiber intake than breakfast non-consumers (17 \pm 0.3g vs. 12 \pm 0.4g) and RTEC breakfast consumers also had significantly higher daily dietary fiber intake than non-RTEC breakfast consumers ($P < 0.001$ for both comparisons). In conclusion, when evaluating the association of breakfast consumption with the lower prevalence of overweight and obesity, types of meals should be considered as an important determinant.

Song et al, 2006 (positive quality), used cross-sectional data to test the association between the intake of RTEC, milk, and calcium using data from the NHANES 1999-2000. Data were stratified according to sex, age and by consumption of breakfast, RTEC and milk. Breakfast consumers tend to be older and white ($P < 0.01$). The highest prevalence of breakfast consumption was found among four- to eight-year-old children (93.5%), adults older than age 71 years (92.1%) and whites (79.3%). Multiple regression analysis was performed to determine the predictability of total calcium intake from breakfast and milk or RTEC consumption. In this analysis, children aged four to eight years were excluded because they were found to have a distinctive amount and pattern of RTEC and milk consumption, leaving a sample of 6,631 subjects. Breakfast consumption, milk with RTEC and milk without RTEC were all significant predictors for daily calcium intake ($P < 0.05$) after controlling for age and ethnicity.

Stockman et al, 2005 (positive quality), conducted a prospective cohort study to determine and compare the distribution of energy and nutrient intakes among meals and snacks, and related eating occasion frequency to the BMI of 180 healthy adolescents males (14 to 18 years old) recruited from local school and community groups in Canada. Anthropometric information and 24-hour diet recall on three consecutive days, including two weekdays and one weekend day, were evaluated. Also, subjects were instructed to self-report the type of every eating occasion, such as breakfast, lunch, dinner and snacks. The relation of breakfast consumption to energy and nutrient intakes was evaluated by categorizing subjects into consistent (consumed breakfast all three days) or inconsistent (skipped breakfast at least one of the three days.) Both dinner and breakfast were the largest contributors of calcium (328.8 \pm 19.4 and 299.0 \pm 16.0 mg, respectively) and iron (4.50 \pm 0.20 and 5.39 \pm 0.35mg, respectively.) Conversely, breakfast was the smallest contributor of energy, CHOs, total fat and saturated fat. Breakfast was the most frequently skipped meal (26%) on at least once of the three days of food records. Consistent breakfast consumers had significantly higher iron intakes relative to inconsistent breakfast consumers (16.4 \pm 0.49 and 13.5 \pm 0.91, $P = 0.0041$). However, there were no significant differences in energy, macronutrient, cholesterol, dietary fiber, calcium or sodium intakes.

Timlin et al, 2009 (positive quality), examined the association of breakfast frequency in both cross-sectional and prospective data from the Eating Among Teens (EAT) project, which was a five-year longitudinal study of eating patterns and weight concerns among adolescents from the Minneapolis/St. Paul, Minnesota, metropolitan area. Surveys were completed in 1998-1999 (time 1) and 2003-2004 (time 2), with a final sample size of 2,216 (1,007 boys and 1,215 girls). The mean age at time 1 was 14.9 \pm 1.6 and at time 2 was 19.4 \pm 1.7 years. The ethnic background of the participants was: 63.1% white, 9.9% black, 17.7% Asian, 3.8% Hispanic, 2.7% Native American and 2.85% mixed or other. Breakfast frequency was assessed with the question "During the past week, how many days did you eat breakfast?" Respondents were classified as never, intermittent and daily breakfast eaters. Also, dietary intake was assessed with the 149-item Youth and Adolescent Food Frequency Questionnaire (YAQ). Results showed that individuals who never ate breakfast were more likely to be girls (16.4%) than boys (13.0%; $P = 0.03$) at baseline. The greatest change over time was observed in boys, with 16.8% decrease of breakfast intake from time 1 to time 2, but no significant (NS) difference by sex. Overall, those who ate breakfast daily were more likely to be white, to come from a higher socio-economic status, and to engage in higher levels of physical activity. In girls, the overall diet of daily breakfast eaters compared with those who intermittently or never ate breakfast was higher in total energy ($P < 0.01$ for both), fiber ($P < 0.05$ and $P < 0.01$, respectively) and cholesterol ($P < 0.01$ for both). In boys, statistically significant differences by daily breakfast eaters and intermittent eater were observed for dietary CHO ($P < 0.05$) and fiber ($P < 0.05$) (higher for daily breakfast) and for the percentage of calories from saturated fat (lower for daily breakfast) ($P < 0.05$). However, values were not significantly different for respondents who had breakfast daily or never.

Van der Heijden et al, 2007 (positive quality), conducted a prospective study aimed to investigate the association between breakfast consumption and long-term weight gain in an adult male population over a 10-year period. Data on body weight, dietary factors, and lifestyle variables were obtained from the Health Professionals Follow-up Study. Dietary data were assessed every four years, using a semi-quantitative food frequency questionnaire (FFQ). This analysis used 1992 as a baseline, which included data from 20,064 healthy men. Of all men, 16.9% reported not usually

consuming breakfast. At baseline, breakfast consumers had a greater estimated daily percentage of energy from carbohydrates (50.1 vs. 46.1%) and estimated total fiber (7.3 vs. 5.0g per day) intake and whole grain intake (29.4 vs. 17.5g per day). Breakfast consumers had lower estimated daily percentage of energy from fat (30.6 vs. 32.6%), polyunsaturated fat (PUFA) (5.9 vs. 6.0%), monounsaturated fat (MUFA) (12.0 vs. 12.8%), saturated fat (10.1 vs. 11.0%) and trans-fat (1.5 vs. 1.7%).

Williams, 2005 (positive neutral quality), conducted a cross-sectional study, the Australian Bureau of Statistics (ABS) was commissioned by Kellogg's (Australia), to analyze data collected in the 1995-1996 Australian National Nutrition Survey. The study aimed to describe the nutrients provided to Australian adults by the breakfast meal and to compare the food and nutrient intakes and health of regular breakfast eaters and breakfast skippers. The survey included 24-hour recalls, physical measurements, and a food habits questionnaire of 10,851 Australians, aged 19 years and older. The findings showed that the typical Australian breakfast was low in fat, high in CHO, and a good source of thiamin, riboflavin, niacin, calcium and magnesium. People who did not eat breakfast cereal were much more likely to have inadequate nutrient intakes, especially of thiamin, riboflavin, calcium, magnesium and iron. Those who regularly ate breakfast had significantly better diets overall, higher in CHOs and dietary fiber, and richer in almost all vitamins and minerals, especially thiamin, riboflavin, folate, calcium, iron and magnesium. For every nutrient, a significantly higher proportion of eaters than skippers met the Reference Daily Intake (RDI) or dietary target on the day of the survey. These differences were significant for thiamin, riboflavin, folate, calcium, and magnesium and also (for women only) iron. The proportion of skippers in the oldest age groups consuming less than 70% of the RDI was more than twice that of breakfast eaters for almost every nutrient, including protein. Adult breakfast eaters also consumed significantly more servings of cereal foods in the day than the breakfast skippers (males, 6.3 vs. 3.4, P<0.001; females (4.4 vs. 2.8, P<0.001) and were more than twice as likely to meet the target for servings of cereal foods (28% vs. 14%, P<0.001). Adult male breakfast eaters were also more likely than skippers to meet the target of >55% energy from CHO (18% vs. 10%, P<0.001). More eaters met the dietary targets for fiber than breakfast skippers, especially in the oldest age groups (males aged 65+, 26.4% vs. 5.4%, P<0.001; females aged 55+, 16.1% vs. 2.1%, P<0.001).

Williams et al, 2009 (positive quality), conducted cross-sectional study to assess whether weight status, nutrient intake and dietary adequacy were associated with breakfast consumption patterns. The study sample, African-American (AA) children aged one to 12 years (N=1,389), was from the 1999-2002 NHANES. There were 7.4% of one- to five-year-old children and 16.9% of six- to 12-year old children who skipped breakfast. Breakfast skippers had lower mean energy intakes than children who consumed RTEC or other breakfast. Compared with those who either skipped breakfast or consumed other breakfast foods, children in the RTEC breakfast category had the highest mean daily intakes of vitamins A and B₁₂, thiamin, riboflavin, folate, and iron (P≤0.05 for all). No differences were found in mean daily intakes of vitamin B₆, niacin, calcium and zinc between breakfast skippers and other breakfast consumers. Those eating RTEC had lower intakes of vitamin E than breakfast skippers (P≤0.05), and children who consumed RTEC for breakfast had the highest intakes from CHOs and total sugars and the lowest intake from total fat when compared with the breakfast skippers and other breakfast consumers groups (P≤0.05). Breakfast skippers and other breakfast consumers had higher intakes of MUFA and PUFA than RTEC breakfast consumers (P≤0.05).

Woodruff et al, 2008 (positive quality), used cross-sectional data to describe weight concerns, dieting and meal skipping of adolescents, and determine associations with Healthy Eating Index-C (HEI-C). Participants were recruited from Ontario and Alberta schools using a two-stage stratified, randomized, sampling procedure. The final sample included 1,826 students from grades nine and 10. Diet quality was assessed using a modified version of the US-based HEI, possible scores range from zero to 100, with 100 points referring to perfect diet quality and lower status indicating larger deviations from the recommended intakes: Poor (≤50 HEI-C score), needs improvement (50-80 HEI-C score) or good (>80 HEI-C score). More females than males skipped breakfast (30% vs. 24%; P=0.008). No differences in meal skipping were observed by grade, body weight, body weight status. The mean HEI-C score across all participants was 69.0% (±13.2), falling into the "Needs Improvement" category. Furthermore, mean diet quality scores were higher for those consuming breakfast (71±12.4 vs. 64±14.0; P<0.001). Participants who skipped breakfast were more likely to have a worse diet quality (OR=0.42 95% CI: 0.33, 0.54) (P<0.001) than those who consumed the meal.

Williams et al, 2007 (positive quality), conducted a cross-sectional study, Kellogg's (Australia) commissioned the Australian Bureau of Statistics (ABS), to analyze data collected in the 1995-1996 Australian National Nutrition Survey. The study aimed to describe the nutrients provided to Australian children by the breakfast meal and to compare the food and nutrient intakes and health of regular breakfast eaters and breakfast skippers. The survey included 24-hour recalls, physical measurements and food habits questionnaire of 3,007 Australian children, aged two to 18 years. Those having breakfast five days or more a week are classified as regular breakfast eaters, while those who said they ate it rarely or never are classified as breakfast skippers. The breakfast meal was self-defined by the participants (data from those two- to 14-years old were obtained through the parent or guardian). The breakfast meal provided between 12% and 19% of the daily energy intake. Those who regularly ate breakfast had better nutrient intakes overall, higher in dietary fiber and in almost all vitamins and minerals, especially thiamin, riboflavin, folate, calcium, iron and magnesium. These differences, however, were not significantly different in the older age groups. There were no significant (NS) differences in daily intakes of sugar or fat between breakfast eaters and skippers, except for boys aged eight to 11 years.

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Author, Year, Study Design, Class, Rating	Population/Subjects	Data Collection and Methods	Definitions of Skipping Breakfast	Prevalence of Skipping Breakfast	Significant Outcomes
Affenito SG et al 2005 Study Design: Longitudinal Cohort Study Class: B Rating:	Data from the NHLBI Growth and Health study. Nine-year longitudinal cohort study. Baseline N=1,015 (100% female; 57% white, 43% African-American). End of Study N=964. Age at baseline: Nine- to 10-year-old children.	Three-day diet record, annually for nine years. Retention rates were: 82% at visit 7th, 89% at visit 10th.	B=intake between 5 am-10 am weekdays or 5 am-11 am weekend days. B Skipper=no B reported on any day of three-day record. B Skipper compared to: • One day of B • Two days of B • Three days of B.	0.9% of white, nine-year-old girls. 2.5% of African-American, nine-year-old girls. 19.1% of white, 19-year-old girls. 24.2% of African-American, 19-year-old girls.	One, two or three-day B Consumers vs. B Skippers had greater estimated daily intakes of calcium and fiber when adjusted for total energy intake. Three-day B Consumers vs. B Skippers had greater estimated total daily calcium (75.6mg per day) and fiber (1.13g per day) intakes when adjusted for race, age,

	Age at end of study. 18-19-year-old adults.				study site, total energy intake, physical activity and parental education.
Dubois L et al 2009 Study Design: Cross-sectional Study Class: D Rating: 	Data from the Longitudinal Study of Child Development, Quebec. N=2,103. N (final)=1,520.	24-hour diet recall. Eating behavior survey for B pattern.	1,549 pre-school children in the Longitudinal Study of Child Development in Quebec (1998-2012, LSCDQ). Quebec, Canada.	B=food intake between 6-9 am. B Skipper=not consuming B every day of the week vs. B Consumer=consuming B every day of the week.	B Consumers vs. B Skippers Total daily energy and nutrient intakes were ND different, except for the protein intake (55.8g for B skippers and 58.7g for B eaters (P<0.05) consumed more energy, CHO and fat at B and total daily protein. B Consumers vs. B Skippers consumed more vegetables, grains and milk products.
Kerver JM, Yang EJ et al, 2006 Study Design: Cross-sectional design Class: D Rating: 	Data from the NHANES III, 1988-1994. N=15,978 (52.6% female). Age: 20+ year-old adults. <ul style="list-style-type: none"> • 82.7% non-Hispanic White • 11.8% non-Hispanic Black • 5.5% Mexican-American. 	24-hour diet recall.	B=self-identified first eating occasion in 24-hour recall. Eating frequency per day: <ul style="list-style-type: none"> • One to two times per day • Three times per day • Four times per day • Five times per day • At least six times per day Eating intake patterns of Breakfast (B), Lunch (L), Dinner (D), Snacks (S): <ul style="list-style-type: none"> • B, L, D, at least two S • B, L, D, one S • B, L, at least two S • B, L, D • L, D, at least two S • Other. B Skipper=L, D, at least two S eating pattern.	17.7% of 20+ year-old adults.	B skippers group consuming lunch, dinner and two snacks, compared with the consumers of B, L and D group, had the lowest intakes of all micronutrients analyzed (Vitamin B 6 1.83±0.04g, folic acid 252±97.29ug, vitamin C 97.6±4.19mg, calcium 818±26.8mg, magnesium 310±5.79mg, iron 14.5±0.25mg, potassium 2,995±67.4mg and dietary fiber 16.8±0.37g) examined except sodium (3,810±66.5mg) (P<0.0001), after adjusting for sex, ethnicity, alcohol intake, vitamins, minerals, BMI, physical activity and income.
Matthys C, De Henaauw S et al, 2007 Study Design: Cross-sectional survey Class: D Rating: 	Data from a cross-sectional survey in the Belgian secondary school system. N=341 (62% female). 13- to 18-year-old adolescents.	Seven-day diet record.	B=self-identified first eating occasion after waking that included a solid food or beverage. B Skipper=no B or limited B (<100kcal)=B Label. No B, usually no B, usually low quality B, or infrequently good quality B=B Score. Label 1+Score 1-3=B Skipper (or Low Quality) vs. Label 5+Score 5=B Consumer (B nearly every day or Good Quality).	13.2% of 13- to 18-year-old boys. 16.9% of 13- to 18-year-old girls.	B Consumers (Good Quality) vs. B Skippers (Low Quality) Overall, the individual B score was less than three (never eat or usually do not eat B). For boys and girls, the energy intake and the proportional contribution of proteins were significantly ↑ in subjects having a good-quality B, score of 5 (P=0.022, and <0.001, respectively). Girls who consumed a good-quality B had a significantly ↑

			<p>Quantitative aspects of B included:</p> <ul style="list-style-type: none"> • Frequency of having B • Relative contribution of target food groups (cereal, dairy products and fruit/vegetable). • Qualitative and quantitative aspects of B were combined into a so-called “individual breakfast score.” 		<p>proportional intake of polysaccharides, than the low-quality B consumers (P=0.002).</p> <p>For boys and girls, the intake at B of the selected micronutrients (Calcium, phosphorous, iron, magnesium, thiamin, riboflavin, vitamin C) was significantly ↑ in subjects consuming a good-quality B (P<0.001 for all micronutrients.).</p> <p>B Consumers (Good Quality) vs. B Skippers (Low Quality) had ↑ estimated intakes of bread, fruit, cereal (girls only), vegetables, milk and milk products, cheese (girls only), fruit juice, water and ↓ estimated intakes of soft drinks.</p>
<p>Nelson M, Lowes K et al, 2007</p> <p>Study Design: Cross-sectional study</p> <p>Class: D</p> <p>Rating: </p>	<p>Data from the National Diet and Nutrition Survey of Young People, 1997 (England).</p> <p>N=1,456.</p> <p>Age: Four-to 18-year-old children and adolescents.</p>	<p>Seven-day diet record, weighed foods.</p>	<p>B Skipper=not reported (assume missed B on all days of seven-day record).</p>	<p>9% of four- to 18-year-old children and adolescents.</p>	<p>62% consumed Cereal B. 29% consumed non-Cereal B.</p> <p>B Consumers vs. B Skippers had greater daily intakes of energy, total protein, CHO and fat, non-starch polysaccharides, folate, vitamins A and C, calcium, iron, zinc and sodium.</p>
<p>Rampersaud GC, Pereira MA et al, 2005</p> <p>Study Design: Narrative Review</p> <p>Class: R</p> <p>Rating: </p>	<p>Summary report.</p> <p>Medline search from 1970 through February 2004.</p> <p>Terms: Breakfast, children and adolescents.</p> <p>47 articles were reviewed:</p> <ul style="list-style-type: none"> • Nine related to nutrient adequacy • 16 related to body weight • 22 related to cognitive or academic performance. 	<p>Not applicable.</p>	<p>Not applicable.</p>	<p>Not applicable.</p>	<p>Breakfast eaters generally consumed more daily calories, yet were less likely to be overweight, and not all studies associated B skipping with overweight.</p> <p>Two studies report that children and adolescents skipped B more than any other meal. The B-skipping prevalence (day of survey) reported in other three studies ranged from 12% to 34%.</p> <p>Six studies showed that B eaters tended to have a ↑ total daily intake of energy compared with B skippers, suggesting that skippers</p>

did not consume more calories at other meals to compensate for the deficit.

Correspondingly, B eaters tended to have ↑ daily intakes of total CHO (from two studies), total protein (from six studies), total fat (from two studies) and saturated fat (one study).

Four studies showed that fiber intake was significantly ↑ in B eaters vs. skippers and the inclusion of a RTEC seemed to contribute to daily fiber intake.

Associations of B habits on serum lipids have been inconsistent.

Breakfast eaters have ↑ daily intakes of micronutrients and are more likely to meet nutrient intake recommendations compared with B skippers.

Nutrients that seem to be particularly affected across a variety of studies and population groups include vitamins A and C, riboflavin, calcium, zinc, and iron. Data related to the effects of B on micronutrient status (i.e., blood or tissue concentrations) are not widely reported except with regard to RTEC consumption.

Seven studies showed that children and adolescents who skipped B did not, on average, make up the nutrient deficits at other meals during the day, which has also been observed in adults (from two studies). One population-based survey data indicate that children and adolescents tend to have similar nutrient intakes from daily meals other than B, regardless of whether they skip or consume breakfast. The same study mentioned that female adolescents who skipped B had ↓ intakes of nutrients at other

					meals, compared with female adolescent B consumers. Several studies showed that the inclusion of RTEC and milk enhance calcium and iron intake.
Song et al 2005 Study Design: cross-sectional Class: D Rating: 	Data from the NHANES 1999-2000. N=4,218. Age: 19+ year-old adults.	24-hour diet recall.	B Skipper=no B self-identified on day of 24-hour recall.	<ul style="list-style-type: none"> • 25.3% of men • 20.6% of women • 19.6% White • 31.1% African-American • 28.4% Hispanic • 32.3% others. 	B Consumers vs. B Skippers: B consumers had significantly ↑ daily dietary fiber intake than B non-consumers (17± 0.3g vs. 12±0.4g), and RTEC B consumers also had significantly ↑ daily dietary fiber intake than non-RTEC B consumers (P<0.001 for both comparisons). Further nutrient analysis not conducted.
Song WO, Chun OK et al, 2006 Study Design: Cross-sectional study Class: D Rating: 	Data from the NHANES 1999-2000. N=6,631. <ul style="list-style-type: none"> • 35.5% White • 23.2% African-American • 33.1% Hispanic • 8.2% Others. Age: At least nine years old. Note: Four- to eight-years old 6.5% excluded from analysis.	24-hour diet recall.	B Skipper=missed B on day of 24-hour recall. Actual estimated milk consumed. RTEC consumption: <ul style="list-style-type: none"> • RTEC B • RTEC + milk B • Other B. 	At least nine: 23.8% Data for at least nine: <ul style="list-style-type: none"> • 25.5% of men • 22.2% of women • 20.7% white • 31.9% African-American • 28% Hispanic • 31.7% others. 	Breakfast consumption, milk with RTEC and milk without RTEC were all significant predictors for daily calcium intake (P<0.05) after controlling for age and ethnicity.
Stockman NK, Schenkel TC et al, 2005 Study Design: Prospective cohort study Class: B Rating: 	Data from the local high school community in Canada. N=180 (0% female). 14- to 18-year-old adolescents. Race and ethnicity not reported.	Three-day 24-hour recall.	B Skipper=missed B on at least one of three days of diet record (Inconsistent B) vs. B Consumer=consumed B on all three days of diet record (Consistent B).	26% of 14- to 18-year-old adolescents.	B Consumers vs. B Skippers had ↑ estimated daily intake of iron (16.4±0.49 and 13.5±0.91, P=0.0041), but not intakes of energy, total protein, CHO, fat, cholesterol, calcium, sodium or fiber.
Timlin et al 2008 Study Design: longitudinal prospective cohort Class: B Rating: 	Data from the Eating Among Teens (EAT)-I, 1998-1999 and EAT-II, 2003-2004 Minneapolis/St Paul, Minnesota, metropolitan area. N=2,216 (54.8% female). Age: 14.9±1.6 year-old adolescents (baseline, 1998-1999) Age: 19.4±1.7 year-old adolescents (Time 2, 2003-2004). • 63.1% White	Youth and Adolescent FFQ.	B Skipper=self-reported “never” had intake of B during the past week. B Consumer=self-reported “daily” intake of B during the past week.	16.4% of 13-17 year-old girls (baseline). 13.0% of 13-17 year-old boys (baseline). 13.8% of 18-22 year-old girls (Time 2). 18.9% of 18-22 year-old boys (Time 2).	For girls (baseline), B Consumers vs. B Skippers: In girls, the overall diet of daily B eaters, compared with those who were intermittent or never eaters was higher in total energy (P<0.01 for both), fiber (P<0.05 and P<0.01 respectively) and cholesterol (P<0.01 for both). In boys, statistically significant differences by daily B eaters and intermittent eater were

	<ul style="list-style-type: none"> • 9.9% Black • 3.8% Hispanic • 17.7% Asian • 2.7% Native American • 2.9% Others. 				<p>observed for dietary CHO (P<0.05) and fiber (P<0.05) (higher for daily B) and for the percentage of calories from saturated fat (lower for daily B) (P<0.05).</p>
<p>van der Heijden AA, Hu FB et al, 2007</p> <p>Study Design: Sub-analysis of the Health Professional Follow-up Study, which was a prospective cohort study</p> <p>Class: B</p> <p>Rating: </p>	<p>Data from the Health Professionals Follow-up Study, 1992 (introduction of B question).</p> <p>N=20,064.</p> <p>Age at baseline: 40- to 75-year-old adults.</p> <p>Age in 1992: 46- to 81-year-old adults.</p>	<p>Semi-quantitative FFQ for past 12 months, 1990.</p>	<p>B Skipper=self-report of "no," did not consume B.</p>	<p>16.9% of 46-81 year old adult men.</p>	<p>B Consumers vs B Skippers had greater estimated daily percentage of energy from CHO (50.1 vs. 46.1%) and estimated total fiber (7.3 vs. 5.0g per day) intake.</p> <p>B Consumers vs. B Skippers had lower estimated daily percentages of energy from fat (30.6 vs. 32.6%), PUFA (5.9 vs. 6.0%), MUFA (12.0 vs. 12.8%), saturated fat (10.1 vs. 11.0%) and trans-fat (1.5 vs. 1.7%) and lower estimated daily alcohol intake (9.7 vs. 13.1g per day)</p> <p>B Consumers vs. B Skippers had greater estimated intake of whole grain (29.4 vs. 17.5g per day).</p>
<p>Williams BM et al 2009</p> <p>Study Design: Cross-sectional Analysis</p> <p>Class: D</p> <p>Rating: </p>	<p>Data from the NHANES, 1999-2002.</p> <p>N=1,389 (100% African-American).</p> <p>Age: One- to 12-year-old children and adolescents.</p>	<p>24-hour diet recall.</p>	<p>B Skipper=self-reported missed B on day of 24-hour recall.</p> <p>B Skipper vs. RTEC.</p> <p>B vs. non-RTEC B.</p> <p>Mean Adequacy Ratio (MAR)=average of the percentage of the Estimated Average Requirement for 13 nutrients (truncated to 100%, if needed).</p>	<p>7.4% of one- to five-year-old children.</p> <p>16.9% of six- to 12-year-old children.</p>	<p>Compare with those who either skipped B or consumed other B, children in the RTEC breakfast category had the highest mean daily intakes of vitamins A and B₁₂, thiamin, riboflavin, folate and iron (P≤0.05 for all). No differences were found in mean daily intakes of vitamin B₆, niacin, calcium and zinc between B skippers and other breakfast consumers.</p> <p>RTEC had lower intake of vitamin E than B skippers (P≤0.05); and children who consumed RTEC for B had the highest intakes from CHO and total sugars and the lowest intake from total fat when compared with the B skippers and other B consumers groups (P≤0.05). B</p>

					<p>skippers and other B consumers had higher intakes of MUFA and PUFA than RTEC B consumers ($P \leq 0.05$).</p> <p>The MAR was highest in RTEC B Consumers ($95.7 \pm 0.2\%$) vs. non-RTEC B Consumers ($93.2 \pm 0.4\%$) vs. B Skippers ($84.3 \pm 1.2\%$).</p>
<p>Williams P, 2005</p> <p>Study Design: Cross-sectional study</p> <p>Class: D</p> <p>Rating: </p>	<p>Data from the Australian National Nutrition Survey, 1995-1996.</p> <p>N=10,851.</p> <p>Age: 19+ year-old-adults.</p>	24-hour diet recall.	B Skipper=self-identified as consuming B "rarely" or "never."	Not reported.	<p>B Consumers vs. B Skippers had \uparrow estimated daily median intakes of energy, protein, CHO, thiamin, riboflavin, niacin, folate, vitamins A and C, calcium, iron, magnesium, phosphorus, zinc (women only), potassium and fiber and lesser estimated daily median intakes of fat and total sugar. B was a good source ($\geq 25\%$ of RDI) of protein, thiamin, riboflavin, niacin, folate (men only), vitamins A (men only) and C, calcium, iron, magnesium and phosphorus, but not zinc or fiber.</p> <p>B made substantial contribution to overall nutrient intake in 65+ year-old men and 55+ year-old women B was low in fat (24-28% of total B energy intake) and high in CHO (56-59% of total B energy intake).</p> <p>B Consumers vs. B Skippers consumed more servings of cereal per day and met dietary targets for daily fiber intake, particularly in 65+ year-old B Consumers.</p>
<p>Williams P, 2007</p> <p>Study Design: Cross-sectional study</p> <p>Class: D</p> <p>Rating: </p>	<p>Data from the Australian National Nutrition Survey, 1995-1996.</p> <p>N=3,007.</p> <p>Age: Two to 18 year old children and adolescents.</p>	24-hour diet recall.	B Skipper=self-identified as consuming B "rarely" or "never."	Not reported.	<p>B Consumers vs. B Skippers had higher estimated daily median intakes of thiamin, riboflavin, niacin, calcium, magnesium and fiber, but these values were NS different in adults.</p> <p>More B Consumers vs. B Skippers met RDI goals for nutrient intakes.</p> <p>B was a good source</p>

					(≥25% of RDI) of thiamin, riboflavin, niacin, vitamin C, calcium and iron. B Consumers vs. B Skippers did not differ in total sugar or fat intake, except in eight- to 11-year-old boys where B. Consumers had higher estimated intakes. B was low in fat (26-30% of total B energy intake) and high in CHO (55% of total B energy intake). B Consumers vs. B Skippers consumed more servings of cereal per day.
Woodruff SJ et al 2008 Study Design: Cross-sectional Study Class: D Rating: 	Participants were recruited from Ontario and Alberta schools using a two-stage stratified, randomized sampling procedure N=1,826 (55.6% female). Age: 13- to 17-year-old adolescents.	24-hour diet recall, web-based. Healthy Eating Index-C (Canada) for diet quality, range from zero=lowest to 100=highest quality.	B Skipper=missed B on day of 24-hour recall.	27.3% of 13- to 17-year-old adolescents. More female (30%) vs. male (24%) B Skippers.	B Consumers had mean±SD HEI-C score higher (71±12.4) than B Skippers (64±14.0), although both groups' scores suggested "needs improvement." Compared to B Consumers, B Skippers had worse diet quality [OR=0.42 (95% CI=0.33, 0.54)].

Research Design and Implementation Rating Summary

For a summary of the Research Design and Implementation Rating results, [click here](#).

Worksheets

 [Affenito SG, Thompson DR, Barton BA, Franko DL, Daniels SR, Obarzanek E, Schreiber GB, Striegel-Moore RH. Breakfast consumption by African-American and white adolescent girls correlates positively with calcium and fiber intake and negatively with body mass index. *J Am Diet Assoc.* 2005 Jun;105\(6\):938-45.](#)

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-  [Stockman NK, Schenkel TC, Brown JN, Duncan AM. Comparison of energy and nutrient intakes among meals and snacks of adolescent males. *Prev Med.* 2005 Jul; 41 \(1\): 203-210. Epub 2004 Dec 10.](#)
-  [Timlin MT, Pereira MA, Story M, Neumark-Sztainer D. Breakfast eating and weight change in a 5-year prospective analysis of adolescents: Project EAT \(Eating Among Teens\). *Pediatrics.* 2008 Mar;121\(3\):e638-45](#)
-  [van der Heijden AA, Hu FB, Rimm EB, van Dam RM. A prospective study of breakfast consumption and weight gain among US men. *Obesity*\(Silver Spring\). 2007 Oct. 15\(10\): 2,463-2,469.](#)
-  [Williams BM, O'Neil CE, Keast DR, Cho S, Nicklas TA. Are breakfast consumption patterns associated with weight status and nutrient adequacy in African-American children? *Public Health Nutr.* 2009 Apr;12\(4\):489-96. Epub 2008 May 27.](#)
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-  [Williams P. Breakfast and the diets of Australian children and adolescents: An analysis of data from the 1995 National Nutrition Survey. *Int J Food Sci Nutr.* 2007 May; 58 \(3\): 201-216.](#)
-  [Woodruff SJ, Hanning RM, Lambraki I, Storey KE, McCargar L. Healthy Eating Index-C is compromised among adolescents with body weight concerns, weight loss dieting, and meal skipping. *Body Image.* 2008 Dec;5\(4\):404-8.](#)