



Breakfast and Health

For decades, mothers everywhere have encouraged their families to eat a good breakfast. Today, mounting research shows that mom's advice was right, based on the considerable health benefits of eating breakfast on a regular basis.

This *IFIC Review* examines several aspects of breakfast and health including: U.S. trends in breakfast consumption and its contribution to a healthful diet; weight management; cognitive and academic performance; and cardiovascular, digestive, and bone health. Barriers to eating breakfast are also examined, and ideas are offered to help food, nutrition, and health communicators break down those barriers.

LOOKING BACK: U.S. BREAKFAST CONSUMPTION IS ON THE DECLINE

According to statistics and national consumption databases, fewer Americans eat the morning meal every day compared to years past; consequently, fewer people are reaping the considerable health benefits of breakfast consumption.

Fewer Adults Are Eating Breakfast

A few decades ago, just about everybody began the day with breakfast. Although most American adults still eat a morning meal, findings from nationally representative surveys (1, 2) indicate the number is trending downward.

Breakfast consumption among adults ages 20 to 74 decreased from 86 percent in 1965 to 76 percent in 1978 to 75 percent in 1991, according to data from the Nationwide Food Consumption Surveys (NFCS) of 1965-1966 and 1977-1978, and the Continuing Survey of Food Intakes by Individuals (CSFII) 1989-1991 (1). Data from the National Health and Nutrition Examination Surveys (NHANES) also reflected this decline, finding that breakfast consumption among adults decreased from 89 percent in 1971 to 82 percent in 2002 (2).

Children Eat Breakfast Less Often As They Get Older

NFCS/CSFII data showed that, from 1965 to 1991, breakfast consumption declined among American children ages one to 18 years, with the steepest drop observed among adolescents ages 11 to 18 years (3).

Data from the 1994-1996 CSFII survey indicated that more than nine out of 10 (91.8 percent) children age five years and younger eat breakfast, as do six- to 11-year-old males (92.9 percent) and females (91.6 percent). But only about three-quarters of males (78.4 percent) and females (74.6 percent) ages 12 to 19 years eat breakfast (4).

More recent NHANES 2001-02 data also indicate that children tend to eat breakfast less often as they get older. Specifically, among children ages two to five years, 96 percent of males and 95 percent of females eat breakfast; among children ages six to 11 years, 87 percent of males and 86 percent of females eat breakfast. However, in the 12 to 19 year age group, only 69 percent of males and 70 percent of females eat breakfast (5).

BREAKFAST: AN OPPORTUNITY TO MEET NUTRITION RECOMMENDATIONS

A large body of research supports breakfast's key role in helping adults and children meet nutrition recommendations.

Regular breakfast consumption is associated with higher intake of several vitamins and minerals, which boosts the likelihood of meeting recommendations for these nutrients (9, 17-20). Conversely, breakfast skippers may not make up for missed nutrients at other meals during the day—whether they are children, adolescents (9), or adults (20, 21).

In particular, breakfasts containing ready-to-eat cereal tend to be higher in micronutrients (due to fortification of these cereals) and lower in fat (9, 14, 17, 22-24). In

Who's Eating Breakfast... and Who's Not?

Among adults...

- About the same number of women (82 percent) and men (79 percent) age 20 years and older eat breakfast (5).
- Older adults are more likely to consume breakfast than younger adults. For example, among young adults ages 20 to 29 years, 71 percent of females and 62 percent of males eat breakfast, but about nine out of 10 men and women age 60+ eat breakfast (5).
- More white (82 percent) and Mexican-American (81 percent) adults age 20 years and older eat breakfast than do black adults (69 percent) (6).
- As years of education go up, breakfast-skipping appears to go down, according to an analysis of CSFII 1994-1996 data. Nineteen percent of adults with an educational level below 12th grade skipped breakfast, compared to 15 percent of those with a college degree (7).
- Americans age two years and older with higher family incomes eat breakfast more often. About three-quarters (74 percent) of individuals with incomes less than \$25,000 eat breakfast compared to 86 percent with incomes of \$75,000 or more. (8).

Among children and adolescents...

- Girls may be more likely to skip breakfast than boys, according to several surveys and studies (3, 4, 9-11), although some data indicate that boys and girls eat breakfast at about the same rate (5).
- Most research shows that white children are more likely to eat breakfast than black or Hispanic children (3, 11-14).
- Research is limited and mixed regarding the impact of income on breakfast-eating among children and adolescents. Some survey data show a positive association between higher family income and breakfast-eating, and some show the opposite or no association (3, 15).

addition, typical breakfast foods—such as whole-grain cereal (oatmeal, ready-to-eat whole-grain cereal), fat-free and low-fat milk and milk products, fruit and 100 percent fruit juice—help people meet recommendations for “food groups to encourage” from the *Dietary Guidelines for Americans*.

Breakfast and Nutrition Recommendations for Adults

Breakfast's important role in helping adults meet nutrition recommendations is supported by findings from a recent research review (25). According to the review, many observational studies show that regular breakfast eaters consume better-quality diets that include more fiber and nutrients and fewer calories compared to breakfast skippers.

Numerous consumption surveys also show several positive associations between eating breakfast and diet adequacy. In general, regular breakfast eaters consume more fiber, calcium, vitamin A, vitamin C, riboflavin, zinc, and iron as well as fewer calories, and less dietary fat and cholesterol (25).

Breakfast and Nutrition Recommendations for Children and Adolescents

A research review of 47 studies examined the association between breakfast consumption and several health-related factors such as nutritional adequacy in children and adolescents (9). The review found that breakfast eaters have higher daily intakes of fiber, calcium, vitamin A, vitamin C, riboflavin, zinc, and iron and are more likely to meet nutrient intake recommendations compared to breakfast skippers.

Breakfast Contributes “Food Groups to Encourage”

The 2005 *Dietary Guidelines for Americans* identify whole grains, fat-free and low-fat milk and milk products, fruits, and vegetables as “food groups to encourage” to meet nutrient recommendations and help reduce the risk of certain chronic diseases. Although many Americans fall far short of consuming recommended amounts (26), research shows that many popular breakfast foods do help people meet recommendations for these food groups.

Breakfast Contributes to Whole-Grain Intake

Whole grains such as whole-wheat flour, oats, barley, and brown rice contribute fiber, vitamins and minerals, plus high levels of antioxidants, and other healthful plant-based nutrients to the diet. The *Dietary Guidelines* recommend consuming at least three (one-ounce equivalent) servings of whole grains daily, which may help reduce the risk of diabetes and coronary heart disease (CHD) and aid in

weight maintenance (27). But, on average, Americans consume only one serving of whole grains daily (28, 29).

Breakfast affords an optimal opportunity to add whole grains to the diet. For instance, either a cup of cooked oatmeal or two slices of whole-wheat toast provide two of the three servings of whole grains recommended by the *Dietary Guidelines*. The following consumption patterns for whole grains support the importance of breakfast for meeting recommendations:

- **Whole grains are most frequently consumed at breakfast (36 percent)**, followed by snacks (33 percent), lunch and dinner (15 percent each), and brunch (one percent) (30).
- **Among adults, hot and ready-to-eat breakfast cereals and yeast breads each provide nearly one-third of whole-grain servings consumed.** Adults who consume whole grains are significantly more likely to meet dietary recommendations for the grain, fruit, and dairy food groups than those who do not consume whole grains (28).

What's for Breakfast? Not the Same Today as Yesterday

In the past several decades, American adults appear to be choosing more lower-fat breakfast food items, such as cereal, low-fat milk, fruit, and juice, and less bacon and eggs. In the period from 1965 to 1991, American adults began consuming more low-fat milk, whole-grain breads, quick breads, higher-fiber ready-to-eat cereals, fruits and fruit juices; and less whole milk, bacon, eggs, butter, margarine and white bread (1). In addition, breakfast food patterns identified as ready-to-eat cereal, cooked cereal, or fruit-containing patterns were lower in fat and higher in fiber and folate, while breakfast food patterns that contained eggs were highest in total and saturated fat and low in fiber, according to CSFII, 1994-96 data (7).

The gradual shift from higher-fat to lower-fat breakfast foods among adults is supported by data collected from 1988 to 1994. Ready-to-eat cereal (17.1 percent) was the most frequently-consumed food at breakfast, followed by breads (15.9 percent), quick breads (11.9 percent), and meat and eggs (10.9 percent) (16). Despite this shift, from 1971 to 2002, the number of calories consumed at breakfast increased, suggesting that adults are eating bigger portions at the morning meal (2).

- **Among children and adolescents ages two to 18 years, ready-to-eat cereals (30.9 percent) are the top contributors of whole grains to the diet**, followed by corn and other chips (21.7 percent), and yeast breads (18.1 percent) (29).

Breakfast Contributes to Fat-Free and Low-Fat Milk and Milk Product Intake

Consuming milk and milk products such as yogurt and cheese is associated with overall diet quality and adequate intake of several nutrients including calcium, potassium, magnesium, zinc, iron, riboflavin, vitamin A, folate, and vitamin D among children and younger and older adults (27).

Milk and milk products provide important nutrients for growing children and teens, including calcium, potassium, phosphorous, and magnesium. The *Dietary Guidelines* recommend that Americans age nine years and older consume three cups of fat-free or low-fat milk or milk products daily, and children ages two to eight years consume two cups daily. In addition, reports from the U.S. Surgeon General (31) and American Academy of Pediatrics (AAP) (32) recommend that children over age eight years consume three servings of milk or milk products each day. According to the AAP, adolescents need four servings daily to meet calcium recommendations.

Despite recommendations, the mean intake of milk products is just 1.7 cups daily among individuals age two years and older (33). Specifically, among adults age 20 years and older, males consume just 1.8 cups of milk products daily and females just 1.4 cups daily. Adolescents ages 12 to 19 also fall short, with males consuming 2.4 cups daily and females 1.7 cups daily. Respectively, boys and girls ages six to 11 years consume 2.2 cups and 1.9 cups daily, while boys and girls ages two to five years consume 2.4 cups and 2.0 cups daily (33).

According to the *Dietary Guidelines*, individuals who are lactose intolerant may obtain Milk Group nutrients by using lactose-reduced or low-lactose milk products, consuming small servings of milk several times a day, taking the enzyme lactase before consuming milk products, or eating other calcium-rich foods such as yogurt (27).

Milk is the most commonly consumed breakfast food, included in almost half (46 percent) of breakfast meals and consumed by 51 percent of individuals who eat breakfast at home (8). These statistics suggest that encouraging people to eat breakfast may help more Americans meet recommendations for Milk Group foods, especially when paired with other common breakfast foods such as hot or ready-to-eat cereals.

Breakfast Can Contribute to Fruit and 100 Percent Fruit Juice Intake

Whole fruit and 100 percent fruit juice are valuable sources of certain vitamins, minerals, and phytonutrients—unique compounds found only in plants. In particular, the fruit category contributes the following important nutrients to the diet: vitamin C, folate, magnesium, potassium, and fiber (27). While most fruit servings should come from whole fruits, a portion of the daily fruit intake can come from 100 percent fruit juice. One-half cup of 100 percent fruit juice equals one-half cup from the Fruit Group.

The USDA Food Guide (*MyPyramid*) provides calorie-based recommendations for amounts to consume from the Fruit Group. For example, the recommendation for a 2,000-calorie reference diet is four servings (two cups) of fruit or 100 percent fruit juice daily. The mean intake of fruit among individuals age two years and older is just 1.6 servings (0.8 cups) daily, suggesting that many Americans fall short on meeting Fruit Group recommendations (33).

Including whole fruit or 100 percent fruit juice at breakfast can help people meet recommendations. For example, a study of 218 low-income women reported that drinking juice and starting the day with juice or fruit predicted a greater total fruit intake for the day (34). Children who eat breakfast at home or at school eat more fruit than those who skip breakfast, according to CSFII 1994-96 data (35).

Various types of 100 percent fruit juice, particularly orange and grapefruit juice, are nutrient-dense (36). An evaluation of CSFII 1994 data (37) reported that consumption of fruit juice provided approximately one-third of daily vitamin C intake in children ages two to five years old. Fruit juice also contributed to folate and potassium intake, although at lower levels than vitamin C (from 7 percent to 12 percent), but higher levels compared to the calories provided by fruit juice (5 percent or less). Additionally, children who consumed higher levels of fruit juice tended to consume more milk and lower amounts of sugar-sweetened fruit drinks and soft drinks. An NHANES 2001-2002 analysis of children ages two to five years reported that those clustering in the fruit juice beverage intake category had significantly higher daily intakes of vitamin C and folate; they also scored higher on the Healthy Eating Index (HEI) than children in other beverage cluster groups such as water and high-fat milk (38). These data suggest certain nutritional and health benefits for younger children who consume 100 percent juice.

The 2005 *Dietary Guidelines* Committee considered the nutritional contribution of 100 percent fruit juice as part of overall fruit intake recommendations. The

Committee reported that for older children and adults, the amount of fruit juice commonly consumed would provide greater amounts of vitamin C, folate, and potassium than commonly-consumed fruits that might be eaten in place of 100 percent juice. The Committee concluded that consuming no more than one-third of the total recommended Fruit Group amount from fruit juice and the remainder from whole fruit would “achieve an optimal balance.” (27)

A recent comprehensive review of studies evaluating fruit juice intake and weight in children and adolescents does not support an association between consumption of fruit juice and weight status. Data do support consumption of 100 percent fruit juice in moderate amounts and suggest that consumption of 100 percent fruit juice may be an important strategy to help children meet current recommendations for fruit intake (39).

BREAKFAST AND A HEALTHY BODY WEIGHT

Numerous observational studies have examined the relationship between breakfast consumption patterns (including frequency and content of breakfast) and body weight and/or body mass index (BMI) in adults, children, and adolescents. Most studies suggest that eating breakfast is linked to measures of a healthier body weight, although more research is needed to establish a causal link.

Breakfast and Weight Management in Adults

Adults who skip breakfast in hopes of shedding a few pounds may discover that this tactic backfires. In fact, skipping breakfast may lead to increased risk for obesity, higher BMI, and an increased risk for weight gain, while eating breakfast may aid in weight management.

For example, findings from the Seasonal Variation of Blood Cholesterol Study (SEASONS, 1994-1998) found that risk of obesity increased 4.5 times in breakfast skippers compared with breakfast consumers (40). Data from NHANES III, 1988-1994 found that people who skip breakfast have higher mean BMIs, even after adjusting for gender, race, socioeconomic status, and other lifestyle factors (16). NHANES 1999-2000 data showed an inverse association between breakfast consumption and BMI in women (22).

Eating breakfast may help prevent weight gain, according to findings from the Health Professionals Follow-up Study (41). This prospective study of 20,064 men ages 46 to 81 years found that breakfast consumption was inversely associated with the risk of a 5-kilogram (11-pound) weight gain. The association was more pronounced in

men with a baseline BMI of 25 or lower. Fiber intake partially explained the association between breakfast consumption and weight gain.

A prospective study of middle-aged men and women from the United Kingdom found that mean baseline BMI was lowest among persons in the highest quintile of percentage of daily energy consumed at breakfast, despite higher daily total energy intake in this group. Although all participants gained weight, increased percentage of daily energy consumed at breakfast was associated with relatively lower weight gain (42).

Eating breakfast each day may be a smart strategy for maintaining weight loss. Findings from the National Weight Control Registry show that 78 percent of people who have successfully maintained a weight loss of 30 pounds or more for at least one year eat breakfast daily and almost 90 percent eat breakfast on four or more days each week. Only 4 percent report never eating breakfast (43).

In a few U.S. and European studies, eating breakfast is not associated with a positive effect on weight. NHANES 1999-2000 data found no significant association between breakfast consumption and BMI in American men (22). A small cross-sectional study on obese Swedish women found no significant difference in frequency of breakfast consumption between the obese group and the control group (44). Another small cross-sectional study of elderly Spanish adults did not find a difference between the number of breakfast skippers in normal weight versus overweight subjects (45).

A recent review of studies on U.S. adults found that eating breakfast may aid in weight control and related disease risks, but cautioned that more research is still needed in larger, randomized trials (25).

Breakfast and Body Weight in Children and Adolescents

Several observational studies suggest that eating breakfast is associated with lower BMI in children and adolescents, and skipping breakfast is associated with higher BMI.

Skipping breakfast was associated with a higher BMI in adolescents, according to data from the Nationwide Food Consumption Surveys of 1965 and 1977-1978, and the 1989-1991 Continuing Survey of Food Intakes by Individuals (3). In a nationally representative sample of adolescents from the NHANES III, 1988-1994 database, eating breakfast every day or some days was significantly associated with a risk of overweight in those with obese parent(s) and was the strongest protective factor in this group (46).

The three-year Growing Up Today Study (GUTS) examined skipping breakfast and weight change in more than 14,000 adolescents. At baseline, children who never ate breakfast were heavier and more likely to be overweight than children who ate breakfast more consistently. However, over the first year, overweight children who skipped breakfast had smaller BMI increases than overweight children who ate breakfast daily. Normal weight children who skipped breakfast tended to have greater BMI increases compared to breakfast eaters, although this finding was not statistically significant (47).

The National Heart, Lung, and Blood Institute Growth and Health Study used annual three-day food records to examine the association between BMI and breakfast-eating habits of 1,213 African-American and 1,166 Caucasian girls over a nine-year period. The girls were nine- or 10-years-old at the study onset. Days eating breakfast were predictive of lower BMI in a basic study model that adjusted for site, age, and race. However, the independent effect of breakfast was no longer significant after parental education, energy intake, and physical activity were added to the model (13).

Additional results from the Growth and Health Study suggest that young girls with high BMIs may benefit from eating breakfast more often. Girls with a high BMI at baseline who ate breakfast more often had a lower BMI at the end of the study (age 19) compared with those who ate breakfast less often. Path analysis indicated that energy intake and physical activity mediated the association between patterns of breakfast eating over time and BMI in late adolescence. The researchers concluded that, "The association between regular breakfast consumption over time and moderation of body weight among girls who began the study with relatively high BMI suggests that programs to address overweight in children and adolescents should emphasize the importance of physical activity and eating breakfast consistently" (48).

Findings from New Zealand's 2002 National Children's Nutrition Survey showed that, among a nationally representative sample of 3,275 children ages five to 14 years, skipping breakfast was associated with a higher BMI (49).

The five-year prospective Project EAT (Eating Among Teens) study examined the association between breakfast frequency and five-year body weight change in 2,216 adolescents. Cross-sectional analyses from an initial survey and follow-up survey five years later revealed inverse associations between breakfast frequency and BMI that were largely independent of confounding and dietary factors. A prospective analysis showed that frequency of breakfast was inversely associated with BMI in a dose-response manner.

Adjustment for weight-related variables (concerns, behaviors, and pressures) seemed to partly explain this finding (50).

Breakfast Components that may Contribute to Weight Management

A breakfast that includes hot or ready-to-eat cereal may be linked to better weight management for adults, children, and adolescents. Adults who ate ready-to-eat cereal, cooked cereal, and quick bread for breakfast had significantly lower BMI than those who skipped breakfast or who ate meat or eggs, according to data from NHANES III, 1988-1994 (16). More recent data from NHANES III, 1999-2000, showed an inverse association between ready-to-eat cereal and milk consumption and BMI in women (22).

The link between a cereal breakfast and better weight management for adults seems to hold up over time based on longitudinal studies. Results from the prospective Physicians Research Study showed that over eight years and 13 years of follow-up, men who consumed either whole-grain or refined breakfast cereal consistently weighed less than those who consumed breakfast cereal less often. Compared with men who rarely or never consumed breakfast cereal, those who consumed one or more servings of breakfast cereal daily were 22 percent and 12 percent less likely to become overweight during follow-up periods of eight years and 13 years, respectively (51).

A breakfast that includes ready-to-eat or cooked cereal may also help children and adolescents attain a healthy weight. The Growth and Health Study examined the relationship between breakfast, cereal consumption, and BMI among girls over time. Results showed that girls who ate cereal on all three days of the study had lower BMI than those who did not eat cereal or ate it on only one or two days. The authors note that the contribution of cereal to BMI may be partly due to calcium-rich foods such as milk that are often consumed with cereal (52).

In a sample of 603 American children ages four to 12 years, those who ate eight or more servings of ready-to-eat cereal over a 14-day period had lower mean BMI and were at significantly lower risk for being overweight than children who ate cereal less frequently. In addition, calcium intakes were higher for children who ate cereal most often. The authors note that because ready-to-eat cereal is most frequently consumed with calcium-rich milk, milk may contribute to the better intake regulation of frequent cereal eaters (23).

A growing body of research suggests that consuming three servings of milk or milk products daily as part of a typical American diet (approximately 35 percent of calories from fat, 49 percent from carbohydrates, 16 percent

from protein, and eight to 12 grams fiber/day) may help maintain a healthy weight (53-55).

To add further support to the potential role of milk and milk products in weight management, a reevaluation of five clinical studies originally designed to measure bone health found that a higher intake of calcium (primarily from dairy foods) was associated with a lower BMI and body weight. Results from this study indicate that women weighed an average of 18 pounds less for every 1,000 mg of calcium consumed (56).

Several additional studies support the potential role of milk products in weight management for adults. For example, a study of healthy adults participating in the Baltimore Longitudinal Study of Aging suggested that a diet rich in reduced-fat milk products and high-fiber foods may lead to smaller gains in BMI in women and smaller gains in waist circumference in both women and men (57). In addition, an 18-month study of healthy, normal-weight young women concluded that increasing dietary calcium through dairy products may prevent fat mass accumulation (58).

Milk products may play a role in promoting a healthy weight and body composition or preventing unhealthy weight gain among children and adolescents as well. Some studies have shown that a higher intake of milk products is associated with a lower percentage of body fat or BMI among children and teenagers (59-61).

Breakfast and Satiety

A growing body of research is exploring the effects of meal composition and timing—including the breakfast meal—on the satiety mechanism. Satiety—or the state of being satisfactorily full—may play a role in weight management.

Certain breakfast foods may be more satiating than others. A study of satiety ratings among 41 healthy female Australian university students showed that oatmeal had the highest satiety value compared to other breakfast foods tested such as bread, eggs, yogurt, and croissants (62).

The satiating effect of a high-protein breakfast was demonstrated in a single-blind, crossover trial of 15 healthy men in the Netherlands. In this study, a high-protein (58.1 percent of energy), dairy-based breakfast decreased post-prandial ghrelin concentration more strongly over time than did a high-carbohydrate (47.3 percent of energy), dairy-based breakfast. Ghrelin is a peptide secreted from the stomach that seems to trigger the hunger signal. The high-protein breakfast also reduced gastric emptying (63). In a randomized crossover study of 30 overweight or obese American women, subjects who ate an egg breakfast reported greater feelings of satiety and

consumed less energy, carbohydrate, protein, and fat for lunch compared to subjects who ate a bagel breakfast. Energy intake following the egg breakfast remained lower for the entire day and the next 36 hours (64).

A randomized crossover study conducted with 15 men and women found that women who ate higher-fiber, higher-fat breakfast meals had greater feelings of satiety and significantly higher cholecystokinin responses than did those eating a low-fat, low-fiber breakfast meal (65). Cholecystokinin is a hormone associated with satiety.

An analysis of self-reported food intake among 867 men and women suggests that eating foods with low energy density (i.e., less energy per gram than other foods) in the morning is satiating and can reduce the amount eaten over the rest of the day. Findings also suggest that low energy density intake at any time of day could reduce overall intake, and that eating late at night may add to earlier food intake to the extent that overall daily intake is greater. The authors caution that these correlative findings require more research to establish whether there is an association between eating at a certain time of day and changes in overall daily intake (66).

Breakfast: Meal of Many Meanings

How do you define breakfast? It seems there's no single definition for breakfast among scientists and consumers alike.

Researchers speculate that the lack of a universal definition for breakfast, as well as different methods for measuring the breakfast meal, has led to differing results in some studies examining the link between breakfast and health (25).

For example, in some studies, breakfast is defined as any eating occasion described as "breakfast" by participants. Other studies provide varying definitions of breakfast such as: the first meal of the day; eaten before or at the start of daily activities; within two hours of waking; any food and/or beverage consumed between 5 a.m. and 9 a.m.; no later than 10:00 a.m.; or a calorie intake between 20 percent to 35 percent of daily energy needs. Some studies do not define breakfast at all.

As for breakfast composition, no specific definition exists. However, self-reported intake data from national surveys such as NFCS, CSFII, and NHANES do provide data such as how often consumers eat particular foods at breakfast and changes in food consumption patterns over time.

BREAKFAST AND COGNITIVE/ACADEMIC PERFORMANCE IN CHILDREN AND ADOLESCENTS

For more than a quarter-century, researchers have examined the relationship between breakfast and various aspects of cognitive and academic performance in children.

Despite the abundance of research, it is not yet possible to draw definite conclusions because of numerous differences in study design, size, methodology, outcomes measured, populations studied, and breakfast definitions and composition (9, 67-70).

Overall, the research supports a positive link between eating breakfast and cognitive and academic performance. For example, a review of 22 studies related to breakfast consumption and academic performance in children and adolescents suggests that eating breakfast may help children do better in school by improving memory, test grades, school attendance, psychosocial function, and mood (9). Breakfast may particularly benefit children at nutritional risk. Key findings are summarized in this section.

Breakfast and Cognition

In some experimental studies, eating breakfast is positively associated with several aspects of short-term memory function for various age groups and types of tests. Specifically, benefits have been reported for recall (71), episodic memory (72), and short-term memory (73-75). However, several studies report no effect from breakfast on short-term memory (74, 76-80). Overall, data are less supportive for the effects of eating breakfast on other cognitive variables such as attention, problem solving, and reading or listening comprehension (9).

Differences in nutritional status may influence breakfast's effect on cognition in the short term. For example, short-term intervention trials conducted in rural populations outside the U.S. indicate that children at nutritional risk seem to benefit most from eating breakfast (74, 78, 81), but in longer-term studies, do not gain additional benefits on achievement test scores compared to adequately nourished children (82, 83).

Breakfast composition may also play a role in children's cognitive performance. A study of U.S. elementary school children compared the effects of instant oatmeal versus ready-to-eat-cereal breakfasts. Among nine- to 11-year-olds, boys and girls showed enhanced spatial memory and girls showed improved short-term memory after consuming oatmeal. Among six- to eight-year-olds, boys and girls showed better spatial memory and better auditory attention and girls exhibited better short-term memory after consuming oatmeal (84). After six- to 11-year-old English

school children consumed a low glycemic index breakfast cereal, they showed significantly less decline in performance on attention and memory tests throughout the morning compared to a high glycemic index cereal (85).

Breakfast and Academic Performance

Numerous observational studies show that eating breakfast has a beneficial effect on academic and achievement test scores (86, 87), grades (88-90), school attendance (86, 88, 89), and tardiness rates (86, 88).

Several improvements were observed in students who participated in a school breakfast program. For example, Minnesota elementary school students participating in a Universal School Breakfast Pilot improved attendance, increased math and reading scores, and reported better concentration and increased alertness and energy (91). Public school students in Philadelphia and Baltimore who increased their participation in the school breakfast program had significantly greater increases in math grades, significantly greater decreases in rates of school absence and tardiness, and significantly lower ratings of psychosocial problems than children whose participation remained the same or decreased (88). Six months after the start of free school breakfast programs, inner-city students who improved their nutritional status also showed significantly greater improvements in attendance and school breakfast participation, decreases in hunger, and improvements in math grades and behavior (89).

In addition, two randomized controlled trials show that school breakfast has a positive effect on achievement test scores and school attendance rates in undernourished rural Jamaican children (82, 83). School attendance rates were improved in a trial of Peruvian children randomized to receive a school breakfast or no school breakfast for a period of three months (80).

Two experimental studies on breakfast skipping (fasting) in well-nourished U.S. school children show mixed results. In one study, skipping breakfast adversely affected students' ability to accurately solve problems, but helped with immediate recall in short-term memory. The authors explain these effects by heightened arousal associated with the brief fasting period (75). In the second study, skipping breakfast adversely affected the students' late morning problem-solving performance (92).

A European study of 195 10-year-old schoolchildren suggested that the amount of calories consumed at breakfast may affect school performance (93). When children consumed more than 20 percent of their recommended daily calorie intake at breakfast, voluntary physical endurance and performance on a creativity test were significantly better than when they consumed less than 10

percent of recommended calories at breakfast.

BREAKFAST AND OPTIMAL HEALTH

Eating breakfast may offer benefits for cardiovascular, digestive, and bone health. In particular, popular breakfast foods such as whole grain cereals and breads, milk and milk products, fruit and 100 percent fruit juices may benefit health.

Breakfast and Cardiovascular Health

Eating the morning meal may help promote cardiovascular health. Studies have shown that breakfast-skipping adults and children had higher blood cholesterol levels than breakfast eaters, especially among those who ate cereal for breakfast (94, 95). Eating breakfast is also associated with heart-protective eating patterns such as lower fat intakes in adults and higher fiber intakes in adults, children, and adolescents (17).

In 1993, the Food and Drug Administration (FDA) approved the first food-specific health claim for foods containing whole-oat sources of soluble fiber (oatmeal, oat bran, and oat flour) and reduced risk of coronary heart disease (96). The decision was based on the large body of evidence showing that the soluble fiber (beta-glucan) in oats and oat-based products can significantly reduce total cholesterol and low-density lipoprotein (LDL) cholesterol as part of a low-saturated fat, low-cholesterol diet without reducing high-density lipoprotein (HDL) cholesterol or changing triglyceride concentrations. A number of groups have performed formal analyses of the literature pertaining to oats and cholesterol lowering subsequent to the FDA's approval of the oat health claim in 1997. Each of these data analyses used a different model and a different collection of peer-reviewed literature. Without exception, all reached the same positive conclusion regarding the ability of oats to lower blood cholesterol (Andon, 2008). Recent research showed that high-fiber oatmeal/oat cereal consumption favorably altered LDL cholesterol subclass in middle-aged and older men (97). In addition, oat antioxidants (avenanthramides) may reduce early atherogenic events (98-101). Emerging research suggests that whole oat and whole oat-based product consumption is consistent with dietary patterns that may favorably alter risk for elevated blood pressure, type 2 diabetes, and weight gain (102).

The relationship between diets rich in fiber and whole grains—components of certain breads and many hot and ready-to-eat breakfast cereals—and reduced risk of coronary heart disease is also well-established (103). A study evaluating the association between breakfast cereal intake

and heart failure among 21,376 participants of the Physicians' Health Study I, found that higher intake of whole-grain breakfast cereals, but not refined cereals, is associated with a lower risk of heart failure (104). A randomized, double-blind trial showed that relatively healthy older adults who consumed one cup of breakfast cereal fortified with folic acid, vitamin B-6, and vitamin B-12 daily for 12 weeks had significantly lower homocysteine concentrations and significantly higher plasma B-vitamin concentrations compared to a placebo group. High homocysteine and low B-vitamin concentrations have been linked to the risk of vascular disease and stroke (105).

The National Heart, Lung, and Blood Institute's DASH (Dietary Approaches to Stop Hypertension) Eating Plan helps control blood pressure, as well as reduce LDL cholesterol levels (106-108). The DASH Eating Plan emphasizes fruits, vegetables, and fat-free or low-fat milk and milk products and also includes whole-grain products, fish, poultry, and nuts. These foods are rich in nutrients expected to lower blood pressure such as the minerals potassium, calcium, and magnesium, as well as protein and fiber (109). The plan includes many common breakfast foods such as milk, fruit and 100 percent fruit juices, and whole grains.

The *Dietary Guidelines* recommend increasing potassium intake as a lifestyle change to prevent or delay the onset of high blood pressure and to reduce high blood pressure (26). In 2000, the Food and Drug Administration authorized use of the health claim, "Diets containing foods that are good sources of potassium and low in sodium may reduce the risk of high blood pressure and stroke" (110). Breakfast foods such as fruit and 100% fruit juice are rich sources of potassium. Milk and cereal products also contain potassium, but it is not as well-absorbed from these sources (26).

Breakfast and Healthy Digestion

It is well known that dietary fiber—found in many breakfast cereals and other grain products, fruits, and vegetables—helps maintain a healthy digestive system by promoting regularity and helping to decrease the incidence of or resolve constipation. Although inconclusive, some research suggests that fiber helps reduce the risk of colon cancer (111, 112). However, most Americans fall far short of meeting Adequate Intakes for fiber (113). Several studies indicate that adults, adolescents, and children who regularly eat breakfast have a higher daily intake of fiber (9, 25).

The effects of probiotics and prebiotics on digestive health are of considerable research interest. Probiotics are beneficial bacteria that may improve digestive health;

prebiotics are indigestible compounds that help probiotics flourish in the digestive tract. These functional components are found in some common breakfast foods such as certain yogurts, yogurt drinks, and some cereals.

Significant evidence shows that yogurt containing sufficient amounts of the live and active cultures *Streptococcus thermophilus* and *Lactobacillus bulgaricus* alleviate symptoms associated with lactose intolerance (114, 115). In addition, probiotic therapy has been shown to shorten the duration of acute diarrhea in children (116). The prebiotic effects of whole-grain wheat breakfast cereal and wheat bran were compared in a double-blind, randomized, crossover study of 31 British adults. The numbers of beneficial intestinal bacteria were significantly higher following consumption of the whole-grain wheat cereal compared with wheat bran (117).

Breakfast and Bone Health

A balanced, varied diet is essential for developing and maintaining strong bones throughout life. Eating breakfast can contribute nutrients important to bone health. In particular, milk and milk products provide calcium, vitamin D, protein, and several other key bone-health nutrients (8, 27). Several studies indicate that adults, adolescents, and children who regularly eat breakfast have higher daily intakes of calcium and other important nutrients (9, 13, 25).

A large body of research supports the role of high calcium intakes in promoting bone health in adults and children (118-122).

In one review that included 52 investigator-controlled calcium intervention studies, all but two of these studies showed that high calcium intakes were associated with positive outcomes such as better bone balance, greater bone gain during growth, reduced bone loss in the elderly, or reduced fracture risk (118).

Perhaps not surprisingly, consumption of ready-to-eat cereal at breakfast is associated with greater daily intake of both milk and calcium among Americans ages four years and older, according to data from NHANES, 1999-2000. Breakfast eaters who ate ready-to-eat cereal with milk consumed seven times more calcium at breakfast compared to those who ate ready-to-eat cereal without milk (123).

NEW WAYS TO THINK ABOUT BREAKFAST AND HEALTH

Emerging evidence suggests that eating breakfast may provide other potential health effects. Three topics are discussed here: insulin levels, metabolic syndrome, and physical energy.

Breakfast, Insulin Levels, and Metabolic Syndrome

Emerging evidence suggests that eating breakfast may positively impact circulating insulin levels. A small randomized crossover trial in 10 healthy women found that those who skipped breakfast had higher fasting insulin levels, as well as higher total and LDL cholesterol, after a test meal compared to those who ate a breakfast that included a whole-grain ready-to-eat cereal and lower-fat milk (124). Another randomized crossover trial conducted with 45 adults with type 2 diabetes found that a low-glycemic load breakfast meal containing psyllium soluble fiber improved the breakfast postprandial glycemic, insulinemic, and free fatty acid (FFA) responses after breakfast, but not after lunch (125). This area warrants further study, but lends support to the role that dietary changes, including eating a nutritious breakfast, may affect the regulation of insulin levels.

Metabolic syndrome is a cluster of risk factors linked with overweight and obesity and associated with increased risk of coronary artery disease and type 2 diabetes. These risk factors include abdominal obesity, high triglycerides, low HDL cholesterol, high blood pressure, and high fasting blood glucose. Metabolic syndrome is diagnosed when at least three of these factors are present. An estimated 47 million American adults have this condition (126).

Research suggests that popular breakfast foods such as whole-grain cereals and breads, milk products, and fruit may play a role in reducing risk for metabolic syndrome.

Diets rich in whole grains may be associated with decreased risk of metabolic syndrome (127-130). Whole grain consumption may mediate the metabolic syndrome in part through the mechanism of insulin sensitivity. Insulin resistance is a primary feature of the metabolic syndrome (131). Some observational and clinical studies (132-136), but not all (137, 138), show that increased whole grain and fiber intake increase insulin sensitivity. In addition, the fiber from whole grain foods may have a greater effect than fiber from other sources. A cross-sectional examination of the prevalence of metabolic syndrome in participants in the Framingham Offspring Study showed that fiber from cereals, but not fruit and vegetables, was inversely related to the prevalence of the metabolic syndrome (133).

Researchers used food frequency questionnaires to study the relationship between metabolic syndrome and consumption of specific foods (e.g., meat, fish, bread and dairy) in nearly 5,000 men and women. Dairy product consumption was associated with lower diastolic blood pressure in both men and women. The consumption of one to four portions of dairy daily was related to lower triglycerides, fasting blood glucose, and lower incidence of metabolic syndrome in men (139).

Results from the CARDIA study, a 10-year prospective study that examined the dietary habits of more than 3,000 adults ages 18 to 30 years, indicated that increased dairy consumption may protect overweight individuals from becoming obese or developing metabolic syndrome (140). In the Women's Health Study, researchers analyzed data from 10,066 women ages 45 years and older who were free of cardiovascular disease, cancer, and diabetes. Results indicated that higher intakes of calcium and dairy products were significantly associated with a lower prevalence of metabolic syndrome (141).

The association between consumption of fruit and metabolic syndrome as a cluster of risk factors is less clear. Some studies (127, 142) but not all (128), have shown dietary patterns that include high fruit consumption may play a role in reducing the prevalence of metabolic syndrome.

Breakfast and Physical Energy

Research with adults in the UK suggests that eating cereal for breakfast is linked with physical energy. In one study, adults with a mean age of 60.9 years who ate cereal daily reported significantly fewer physical symptoms, fatigue, emotional distress, anxiety, and depression compared to other groups (143). Another study found that consuming a high-fiber breakfast cereal was associated with less fatigue, emotional distress, and fewer cognitive difficulties among men and women with a mean age of 52 years (144).

BREAKFAST AND BUILDING HEALTHFUL LIFESTYLE HABITS IN CHILDREN AND ADOLESCENTS

Adolescents who skip breakfast may exhibit less healthful dietary behaviors, such as irregular eating patterns and an increased intake of less-nutritious foods (145, 146). Findings from New Zealand's 2002 National Children's Nutrition Survey showed that children who missed breakfast were less likely to meet recommendations for fruit and vegetable consumption and more likely to consume less-nutritious snack foods (49).

Family interaction and parental role-modeling of healthful habits, such as eating breakfast, may exert a lasting effect on children. For example, teens who ate family meals were more likely to practice healthful habits when they got older, according to a five-year longitudinal study in Minnesota. Family meal frequency predicted more breakfast meals for females and higher intakes of fruit, vegetables, dark-green and orange vegetables, and key nutrients, and lower intake of soft drinks for both sexes during young adulthood (147).

STRATEGIES FOR FOOD, NUTRITION, AND HEALTH COMMUNICATORS TO ENCOURAGE BREAKFAST CONSUMPTION

Given the substantial health benefits of breakfast, why is breakfast eating in the U.S. declining and how can food, nutrition, and health communicators help reverse this trend? Both the scientific literature and consumer research point to several reasons why people may miss the morning meal. Understanding these factors can help communicators formulate appropriate strategies that encourage more people to reap the benefits of a healthful breakfast.

Why People Skip Breakfast

Children who go without breakfast may do so because of hectic morning schedules. Parents may lack time to prepare a nutritious breakfast for their children because of early-morning school bus schedules, long commutes to jobs, and nontraditional work hours. Some children, especially adolescents, say they're not hungry when they wake up. Millions of U.S. families cannot afford a healthful breakfast every day (148, 149). In addition, children and adolescents may skip breakfast in a misguided attempt to lose weight (9, 150, 151).

Increased autonomy during adolescence, when breakfast-skipping rises sharply, may play a role in breakfast choices (152). In one study, adolescents allowed to make their own decisions about what they ate were 25 percent more likely to skip breakfast (10).

According to the 2008 *IFIC Foundation Food & Health Survey*, 92 percent of Americans perceive breakfast to be either extremely or somewhat important, yet only 46 percent eat breakfast each day. Some reasons the survey respondents indicated for skipping breakfast included "not hungry right after I wake up," "not enough time," "it's not convenient," "forget," and "not sure what to eat." However, consumers did identify several motivators that were likely to increase their breakfast consumption including: "eating breakfast can help increase physical energy," "eating breakfast can help increase mental focus," "eating breakfast can help maintain a healthy body weight," and "eating breakfast can help maintain good health" (153).

Strategies to Encourage a Healthful Breakfast

- Beat the time barrier by suggesting quick, nutritious, and tasty options from the *Dietary Guidelines*' "food groups to encourage." A breakfast of hot oatmeal or ready-to-eat whole-grain cereal with fat-free or low-fat milk or yogurt, and fruit or 100 percent fruit juice is a fast and healthful way to start the day.
- Suggest tasty, untraditional breakfast ideas. Some options are a frittata (Italian omelet) made with vegetables and reduced-fat cheese, served with whole-grain toast and 100 percent fruit juice, or a liquado (Latin American blended beverage similar to a smoothie) made with low-fat milk, tropical fruit and ice.
- Give on-the-go options. There's no rule that breakfast must be eaten at the kitchen table. Suggest portable breakfast foods such as instant oatmeal or ready-to-eat cereal, whole-grain bagels, hard-boiled eggs, cartons of yogurt, pieces of fresh fruit, and single-serving containers of low-fat or fat-free milk and 100 percent fruit juice.
- Encourage parents to step up to the plate to be breakfast-eating role models for children and teens. Point out the benefits of using the breakfast meal as an opportunity for the family to connect and communicate.
- Educate weight-conscious clients that skipping breakfast is not an effective weight management strategy, and that eating a healthful breakfast may aid weight management efforts.
- Teach students that eating breakfast may sharpen their performance in school.
- When economics is an issue, advise parents on how to choose and prepare more affordable breakfast foods, and discuss how these foods can serve as nutritious options at other meals as well.
- Advocate participation in school breakfast programs, when appropriate and available.

For more information on the health benefits of breakfast, as well as helpful tips for consuming the morning meal, please visit <http://ific.org>. ■

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International Food Information Council Foundation
1100 Connecticut Avenue, N.W., Suite 430
Washington, DC 20036
<http://ific.org>