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The Science of Nutrition

Research on the relationship between a healthful lifestyle and academic achievement supports this equation: good nutrition + exercise = optimal learning.

I've heard that breakfast helps kids do better in the classroom but how?

Can certain foods enhance a child's learning or memory?

Do supplements help children perform better in the classroom?

Should I cut classroom time to include physical activity sessions?

The questions, points of view, and passion that parents and educators have about nutrition and its impact on a child's health and development can be overwhelming. The discussion will become more intense as:

- Consumer interest in nutrition and health grows,
- Science uncovers more evidence that some foods improve health and learning, and
- The food industry responds by designing functional food products to optimize health.

Supporting the health of the whole child is dearly essential for optimal achievement.

Leading nutrition scientists often challenge the theories about nutrition and its effect on learning, achievement, and well-being; some label specific claims *junk science.* How do we separate fact from fiction, legitimate science from junk science?

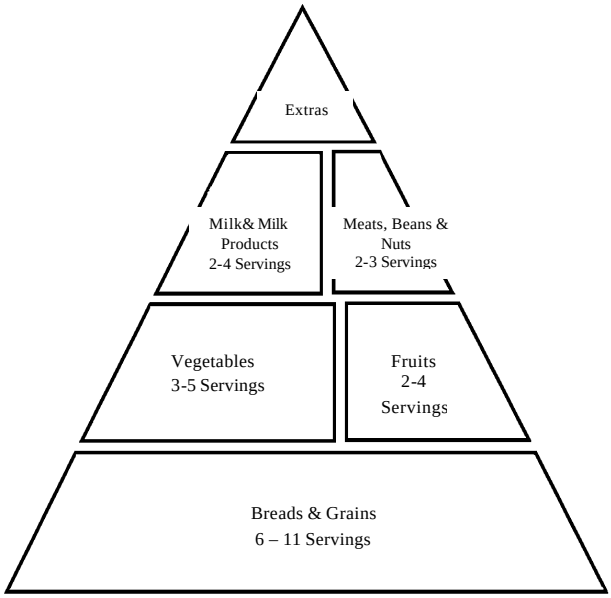
Compelling research confirms that proper nutritional support is crucial to maximize brain functioning and to enhance learning. Supporting the health of the whole child is clearly essential for optimal achievement. The good news is that helping children reach their fullest potential doesn't have to be complicated or involve obscure or expensive foods and supplements. Healthful habits – nutritional, social, environmental, and lifestyle – learned early in life help ensure normal physiological and neurological growth and development. This translates into achieving optimal learning – the abilities to recall information, to problem solve, and to think critically.

Fueling Healthy Minds and Bodies

All foods have a place in the eating experiences of children. Early on, children should encounter a wide range of foods, including foods from different cultures. Although nutritious foods should be emphasized, no foods should be forbidden (California Coalition for Healthy Children, 1992). Restrictive diets, such as those for adults in chronic-disease treatments, are inappropriate for children and can jeopardize normal growth and development.

The Food Guide Pyramid for Young Children, an adaptation of the Food Guide Pyramid from the U.S. Department of Food and Agriculture, exemplifies the public health community's acknowledgement of these principles. This food guide focuses on the food preferences and nutritional requirements of young children, ages 2 through 6, and should be the foundation for formulating a child's diet (U.S. Department of Agriculture, Center for Nutrition Policy and Promotion, 1999). From a health standpoint, this tool supports food choices that enhance growth and development. The original Food Guide Pyramid recommends a food plan for older children, adolescents, and adults. See Figure 1 for a food pyramid adapted to the dietary needs of school-age children.

Figure 1
Food Guide Pyramid for School Age Children



Several dietary components support brain function and neurotransmitter activity. Because this area of research is evolving and dynamic, scientists recommend a wide range of foods as nutrient sources, not single-nutrient supplements. The most important components known today are protein, fat, B vitamins, iron, chorine, and antioxidants. Refer to Figure 2 for specific nutrients, their food sources, and their role in brain function.

FIGURE 2

Sources of Nutrients and Their Roles in Brain Functioning

Nutrient	Common Food Source	Role in Cognitive Function
Iron	Liver, spinach, asparagus, clams, beans, peas, enriched bread, cereal	▪ Transports oxygen to brain ▪ Involved in red blood cell formation ▪ Deficiencies can impair the child's ability to concentrate (Pollitt, 1993).
Protein	Meat, fish, seafood, eggs, dairy products, grain products, legumes	▪ Provides the amino acid tyrosine needed for the release of key neurotransmitters, resulting in increased alertness and motivation (Wurtman, 1988).
Fat	Oils, salad dressings, butter, margarine, lard layers on meat. Most fats are hidden because they are added during food preparation.	▪ In combination with protein, sustains glucose breakdown longer ▪ Carrier of fat-soluble vitamins A, D, E, and K and essential fatty acids, which form nerve cell membranes. ▪ Over- or under-consumption can trigger a neurotransmitter imbalance (Garrison & Somer, 1995).

Choline	Produced in the body and provided in several food sources: egg yolks, meat, wheat germ, peanuts, soybeans	▪ Needed to produce acetylcholine ▪ Low levels have been associated with memory loss. ▪ May improve memory performance (Mark & Mark, 1989).
B Vitamins	B_1 (thiamin): enriched breads and cereals, pork, peas, pecans B_6: chicken, fish, whole grains, egg yolks, bananas, avocados B_{12}: liver, meat, eggs, dairy products	▪ B_1: promotes the body's ability to use glucose. Deficiency can result in mood changes and reduced attention span (Garrison & Somer, 1995). ▪ B_6: involved in acetylcholine metabolism and activity. Deficiency can impair memory (Garrison & Somer, 1995). ▪ B_{12}: supports formation and maintenance of myelin sheaths that surround nerve cells. Inadequate intake results in memory loss, confusion, and impaired physical function (Garrison & Somer, 1995).
Antioxidants (vitamins A & E)	Vitamin A: liver, eggs, cheese, milk, yellow and orange vegetables Vitamin E: dark leafy vegetables, cabbage, eggs, tomatoes	▪ Vitamin A helps cell growth and fights infection. ▪ Vitamins E & A protect brain and body against free radicals, which cause cell destruction. ▪ Vitamin E deficiency can affect the nervous system by interfering with the normal nerve myelination (Garrison & Somer, 1995).

How can we ensure that our students are getting these "brain" nutrients? The easiest way is to encourage their parents to follow the recommendations in the Food Guide Pyramid. The serving suggestions for the five food groups supply adequate consumption of these nutrients. Urging variety, balance, and moderation may sound trite and dated, but these principles are more important than ever. Offering children adequate food choices and helping them establish healthful eating habits will support not only physical growth but also optimal functioning of the brain (Fogarty, 1997).

We recognize that these general guidelines will be appropriate in the majority of, but not all, situations. Other factors inhibit the proper nourishment of the child, not the least of which are poverty and hunger. Clearly, different priorities and interventions come into play in those situations.

Mom Was Right About Breakfast

What simple activity can help increase student attention, decrease illness and absenteeism, and increase test scores? Eating breakfast! Breakfast consumption reduces the physical symptoms of stomach pain, headache, muscle tension, and fatigue, all of which interfere with learning. Making sure that students have breakfast goes a long way toward facilitating their success. School personnel should recognize that they have a unique opportunity to reinforce the importance of breakfast, whether consumed at home or through their school's breakfast program.

Although we in the United States don't see the starvation situation found in developing countries, we do grapple with transient hunger and meal skipping. Without an adequate daily refueling of nutrients from food, the body places learning behind its need to sustain life-support functions. Therefore, skipping a meal affects learning.

A recent study concluded that as many as half of low-income elementary children skipped breakfast (Dixit, Houser, & Sampson, 1999), which is, according to a Tufts University study, the most important meal of the day. Children who eat a school breakfast perform better on standardized tests (Tufts University School of Nutrition, Center for Hunger, Poverty, and Nutrition, 1995). Additional research studies indicate that children who eat breakfast

- have improved attention in late-morning task performance;
- retrieve information more quickly and accurately;
- make fewer errors in problem-solving activities; and
- concentrate better and perform more complex tasks.

What the child eats for breakfast is also important. A meal comprising protein, fat, starch, and sugar will prevent drops in blood sugar for several hours, whereas a breakfast of just starch and sugar will sustain a child for only one to two hours. A drop in blood sugar is associated with a decline in energy and the onset of hunger symptoms. Consequently, a meal that includes foods from several food groups provides the most benefit to the child, both educationally and physically. Simple breakfasts can be prepared quickly and easily:

- juice and cereal with low-fat milk;
- toast with peanut butter and a piece of fruit, or
- a fruit smoothie made with yogurt.

The Social Aspects of Meals

Sharing meals with family and friends nurtures and strengthens relationships, promotes positive communication, and offers a time to celebrate cultural and family traditions (California Coalition for Healthy Children, 1992). New studies indicate that family meals are on the increase (Newport, 1997). A national poll of high school seniors showed higher scholastic scores among students who frequently shared meals with their families (Wildavsky, 1994). A 1995 survey of high-achieving teens showed that those who regularly ate meals with their family tended to be happier with life and their prospects for the future (Who's Who, 1995).

Nurturing the whole child – mentally and physically – works better when a school creates an atmosphere that supports socialization and shared meals. Schools can support this socialization in multiple ways:

- Invite parents to join their children for breakfast at school.
- Encourage school staff, including the principal and teachers, to join students in the cafeteria at lunchtime.
- Ensure that students have adequate time to eat in an unhurried manner.

Movement and the Mind

Physical activity also plays a role in creating an optimal learning condition for the brain. Studies suggest a connection between activity and increased levels of alertness, mental function, and learning. A Canadian study of 500 school children showed that increased gym time related positively to better scores on exams (Hannaford, 1995). Animal studies indicate that regular exercise in the form of running may trigger the growth of new brain cells responsible for learning and memory (Hotz, 1999).

Exciting new discoveries support the link between physical activity and improved learning. Research indicates that exercise increases blood flow to the brain, which allows more oxygen and glucose to flow through the brain (Hannaford, 1995), and releases endorphins, which have a positive impact on mood.

Separating Fact from Fiction

It is not easy to sift through pieces of nutrition or health advice and glean what's credible and discard what isn't when it comes to guidelines or recommendations. But here's a start.

Fiction

Food allergies are common in children. Allergies cause some behavior problems.

Fact

Several food-related conditions are commonly misclassified as food allergies. In fact, less than 20 percent of adverse food reactions are true food allergies requiring the elimination of the offending substance. More common are food intolerances, the lack of sufficient amounts of a key enzyme to digest a food component. The

most common candidates for true food allergies are eggs, wheat, and milk – and many children outgrow their allergies to eggs and milk. Other high-risk foods are nuts, fish, shellfish, chocolate, and citrus (Garrison & Somer, 1995).

Further, true allergies generally manifest themselves through respiratory, gastrointestinal, or skin symptoms. Allergies manifesting in mood swings or behavior changes without accompanying physical symptoms are very rare, according to the leading public health agencies (Wurtman, 1988). Claims of feeling anxious, depressed, or agitated because of food allergies are often overstated.

The good news is that for many food intolerances, most individuals can still eat small amounts of the food without significant side effects. For lactose intolerance (the sugar found in milk), for example, research shows that individuals can consume up to two cups of milk a day without symptoms (Suarez, Savaiano, Arbisi, & Levitt 1997). Further, some dairy products, such as chocolate milk, yogurt, and aged cheeses, are better tolerated.

All foods have a place in the eating experiences of children.

Fiction

A vegetarian diet is always appropriate for a young child. It can provide the nutrients needed for both mental and physical development.

Fact

Well-balanced diets stressing variety, moderation, and balance over time – whether vegetarian or not – support a child's normal growth and development. Lacto-ovo diets that include milk products and eggs can satisfy the nutritional needs of a child. Strict vegan diets with no animal products require careful planning and the advice of a registered dietitian to ensure an adequate intake of protein and such other essential nutrients as calcium, iron, zinc, and vitamin B_{12}.

The health benefits of soy have gained the attention of the popular media. To be sure, soy contains important dietary components, such as choline, and has been associated with significant decreases in serum cholesterol and triglycerides (Anderson, Johnstone, & Cook-Newell, 1998). It certainly is a high-quality protein source, along with meats, legumes, beans, and yogurt. However, many researchers and public health advocates believe that soy foods are a double-edged sword, conferring both benefits and risk.

For example, Swedish researchers concluded on the basis of school case studies that soy has been underestimated as a food allergy, especially for children with asthma and peanut allergies (Foucord & Malnheden, 1999). Moderation is a key principle here. As with any food component, excessively high intakes can occasionally present negative side effects and rarely reap extraordinary benefits.

Fiction

Many supplements and special products are available that enhance a child's ability to learn. Thank goodness, because it is difficult to get the proper nutrients through diet.

Fact

It is not difficult for a child to obtain needed nutrients through a diet reflecting choices from all food groups. The Daily Recommended Intakes and the Recommended Dietary Allowances issued by the National Academy of Sciences are developed from exhaustive reviews of the latest nutrition research. They are being updated to reflect intakes of nutrients needed to support optimal health, not just to prevent deficiency diseases (Institute of Medicine, Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, 1997). The levels recommended for vitamins, minerals, and other dietary components can be met through diets reflecting the principles of variety, moderation, and balance over time.

Children need the calories and "package" of nutrients found in whole foods. A heavy reliance on supplements raises concerns. For most herbal supplements, the research on appropriate consumption levels is sparse and inconclusive (Rotblatt, 1999). Foods fortified with herbs and marketed to improve cognitive function are, as yet, unproven. In addition, it's questionable whether people will continue taking supplements over the long term.

Evaluating Claims

First and foremost, consider the information source before accepting nutrition advice. Does it come from a reputable health organization that bases its recommendations on sound scientific research? Does it come from a credentialed health professional with specific training in nutrition? Because most physicians do not have specific course-work in nutrition, a medical degree alone may not be enough.

Here are 10 Red Flags of Junk Science, warning signs identified by the Food and Nutrition Science Alliance, a coalition of professional nutrition and scientific societies (Harvard School of Public Health and International Food Information Council Foundation, 1998). Any one of these flags should raise suspicion:

- Recommendations that promise a quick fix
- Dire warnings of danger from a single product or regimen
- Claims that sound too good to be true
- Simplistic conclusions drawn from a complex study
- Recommendations based on a single study
- Dramatic statements that have refuted reputable scientific organizations
- List of "good" and "bad" foods
- Recommendations that help sell a product
- Recommendations based on studies published without peer review
- Recommendations from studies that ignore differences among individuals or groups

A Call to Action

What steps can educators take to ensure healthy minds and bodies for children?

Support the school's breakfast and lunch programs. The food served in our school cafeterias deserves support, not disdain. Every lunch must contain one-third of the Recommended Dietary Allowance (RDA) for specific key nutrients, and every breakfast must contain one-fourth of the RDA for specific nutrients. Additionally, school meals must conform to the U.S. Dietary Guidelines, which means that on a weekly average, no more than 30 percent of the calories can be from fat (U.S. Department of Agriculture, Food, and Nutrition Services, 1998). Complex-carbohydrate sources, not simple sugars, comprise a larger portion of the calories than in the past; and protein sources include meats, beans and legumes, nuts, cheese, and yogurt.

The National School Lunch Program serves about 25 million students daily; 5 million are served breakfast. Children participating in these programs consume more of the Recommended Dietary Allowance for key nutrients than those who do not (Radzikowski, 1984). Help position healthful food choices for children in a living laboratory – the cafeteria.

Support health and nutrition education in the classroom. The health and well-being of children significantly affect their overall achievement in the classroom. Although no standardized test addresses health and nutrition directly, well-nourished minds perform better on the tests that schools administer. Equip children with the skills to make healthful food and lifestyle choices. It is time well invested in an admittedly overscheduled school day.

Be sure that the information also reaches parents and families. It's important that parents reinforce and model healthful habits at home.

Support daily physical education. Do not trade scheduled physical activity time for the so-called more important subjects in the classroom, such as math and language arts. Aside from its obvious health benefits, physical activity has direct, positive benefits on the functioning of the brain. Movement stimulates the learning process

and results in more efficient and productive classroom time for the children. And don't forget the importance of modeling an active lifestyle.

Children need the calories and "package" of nutrients found in whole foods.

Scrutinize and challenge the claims of special supplements or products. Although a wealth of information is readily available, much of it is inaccurate, misleading, or unfounded. Filter the information and base your recommendations on credible information and proven research results.

Coordinate your efforts throughout your school and community setting. The commitment of a single principal or teacher is significant, but consider the impact when parents, families, and an entire school community focus on helping children reach optimal achievement. Create a network of educators and parents. The Centers for Disease Control and Prevention (CDC) have developed comprehensive school health guidelines that schools and districts can use as a blueprint (CDC, 1996).

For children to be successful in school, educators cannot ignore the importance of establishing and supporting healthy lifestyle habits. Research clearly validates the essential natures of health education. Schools can and should take a lead in this crucial nurturing of our children.

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