

10 Nutrition For Learning – Feeding The Starving Brain

1. Boys and girls showed enhanced spatial memory and girls showed improved short-term memory after consuming oatmeal.
2. Younger children had better spatial memory and better auditory attention and girls exhibited better short-term memory after consuming oatmeal.

Due to compositional differences in protein and fiber content, glycemic scores, and rate of digestion, oatmeal may provide a slower and more sustained energy source and consequently result in cognitive enhancement compared to low-fiber high glycemic ready-to-eat cereal. These results have important practical implications, suggesting the importance of what children consume for breakfast before school.

An aside- timing of breakfast consumption and school performance

Researchers at the pediatric unit in the B Kaplan Hospital in Israel found that children who ate breakfast at school scored notably higher on most of the test modules than did children who ate breakfast at home and children who did not eat breakfast. Their results conclude that routinely eating breakfast two hours prior to being tested does not improve cognitive functions in 11- to 13-year-old elementary school students, but food supplementation 30 minutes prior to taking a test notably improves scoring.

School/home challenge—serve a nutritional snack/meal containing a complete protein and complex carbohydrate for children 30-45 minutes before their work cycle (a time when the children are presented with cognitive tasks).

Oatmeal-cookie oatmeal is the children's number one choice. We prepare and serve this sumptuous whole food 3-4 days of the school week. (Recipe in *Recipes For Learning* Section.)

A word about whole grains

The new USDA MyPyramid is now recommending that we eat 3 servings of whole grains daily. Nutritional scientists have been trying to get that information to the public for years. Processing grains strips them of vital nutrients (such as B-complex and magnesium) and the conversion of essential fatty acids which are vital for vascular and neurological health. Whole grains also have a lower glycemic index which is converted into energy slowly and provides busy bodies and minds with consistent slow burning fuel.

Definition of a whole grain

Whole grains or foods made from them contain all the essential parts and naturally occurring nutrients of the entire grain seed. If the grain has been processed (e.g., cracked, crushed, rolled, extruded, and/or cooked), the food product should deliver approximately the same rich balance of nutrients that are found in the original grain seed.

If a food item is labeled as whole grain it must have similar proportions of the germ, bran and starchy endosperm found in the harvested kernel. (Hint-look for brown specks throughout the product, not just on the crust.)

Carbohydrates

Too much sugar or the wrong kind of carbohydrate may disrupt the brain's ability to properly use and make essential nutrients it needs for development and peak performance. (Just because a food contains complex carbs, it does not mean it is healthy. For example, white bread contains complex carbs but they have been refined and do not contain many nutrients.)

Carbohydrates refers to a group of compounds containing carbon and water. A carbohydrate is the body's main source of energy. There are three major types of dietary carbohydrates: sugars or simple carbohydrates; starches or complex carbohydrates; and fiber. Fiber is not digested or absorbed by the body. However, it does aid in digestion and offers protection against some diseases. All three are similar in that they are chains of units called monosaccharides, which are eventually converted into glucose, the primary fuel for cell metabolism and brain activity.

During digestion, complex carbohydrates are broken down into sugars. These sugar molecules move into the bloodstream and then into the body's cells where they are converted into energy. Simple sugars and refined carbohydrates do not need to be broken down, so they get absorbed into the bloodstream more quickly than the complex carbohydrates. An exception is fructose, a sugar that is found in fruits and juice. Fructose gets broken down very slowly, even more slowly than many complex carbs.

The best sources of energy are complex carbohydrates. Complex carbohydrates are like time-released energy capsules, providing slow and constant energy. The stomach feels full longer and the body does not experience the highs and lows of blood sugar swings. This is due to the dietary fiber in complex carbohydrates shielding the inherent resistant starch. This slows the release of sugar molecules into the bloodstream.

Complex carbohydrates are found in whole grains, nuts, seeds, vegetables, fruits, and legumes such as lentils, peas, and beans. These foods provide the little learner with vitamins, minerals, and fiber as well as energy.

Too much sugar or the wrong kind of carbohydrate may disrupt the brain's ability to properly use and make essential nutrients it needs for development and peak performance. (Just because a food contains complex carbs, it does not mean it is healthy. For example, white bread or whole wheat bread contains complex carbs but they have been refined and do not retain the fiber and natural resistant starch content of the whole grain or its many nutrients.)

Little and Big Learner's Fact: Breakfast composition affects learning ability

Nutritional scientists at Tufts University examined the relationship between breakfast composition and cognitive performance in elementary school children. Two experiments compared the effects of two common U.S. breakfast foods and no breakfast on children's cognition. The two breakfasts were instant oatmeal and ready-to-eat cereal. Results with 9- to 11-year-olds showed that breakfast intake enhances cognitive performance.

Vegetarians can still eat a healthy diet by eating soy protein (which has a pattern of amino acids similar to animal proteins) and combining foods such as grains and legumes that have complementary amino acid profiles that make complete proteins.

Grains + Legumes

Legumes + Seeds & Nuts

Grains + Eggs or Dairy Products

Legumes + Eggs or Dairy Products

Seeds & Nuts + Eggs or Dairy Products

Examples of Grains: whole grain bread, pasta, corn, rice, oats

Examples of Legumes: peanuts, lentils, kidney beans, soybeans, yellow, green and black-eye peas, chick peas.

1. whole grain bread with peanut butter
2. brown rice and black beans
3. whole grain tortillas with beans
4. pasta e fagioli (pasta and bean soup)
5. macaroni and cheese
6. tempeh (fermented tofu) with rice
7. hummus with falafels
8. lentils with chick peas and rice
9. pasta with pine nuts
10. almonds in yogurt

It is very important to start your child's day off with a breakfast containing a complete protein to help support mental alertness and brain function. Refer to the list of neurotransmitters which rely on the amino acids found in protein and their supportive role in the physiology of mood, attention, and learning.

Little and Big Learner's Fact: Dietary "complete proteins" improve brain function

Sobakin MA et al studied the effect of a diet that included high-protein products containing complete protein on the health status and performance capacity of school children during their school hours. Under observation were 60 school children, aged 13 to 14 years, who were learning two foreign languages. School children receiving a specialized ration were noted to show a number of positive regular changes. Their physical state, physiological characteristics and the functional state of the central nervous system demonstrated a definite improvement.

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Little and Big Learner's Fact: Protein malnutrition can affect behavior and school performance

Galler JR et al studied the academic performance of 129 Barbadian children (77 boys and 52 girls), 5 to 11 years old, who suffered moderate to severe protein-energy malnutrition in the first year of life compared with the performance of matched comparisons, children who had no history of malnutrition.

Children with a history of malnutrition were found to have lower performance on eight out of nine academic subject areas: language arts, mathematics, general science, social science, reading, health, religion, and arts/crafts.

Current socioeconomic status is not directly involved in altering academic performance whereas the early history of malnutrition and its accompanying conditions at the time of the illness are leading contributors to altered behavioral outcome and school performance.

Good sources of complete proteins:

Source	Serving Size	Grams of Protein
Tuna Fish	4 oz	25-30
Lean Beef	4 oz	30
Chicken Breast	4 oz	25
Cottage Cheese	½ cup	15
Tofu (firm)	4 oz	13
Plain Yogurt	1 cup	12
Milk	8 oz	8
Egg	1 whole	6

Good sources of complementary proteins for vegetarians:

Source	Serving Size	Grams of Protein
Tempeh	4 oz	20
Pumpkin Seeds	¼ cup	15
Lentils	4 oz	9
Almonds	¼ cup	8
Soy Butter	2 tbsp	8
Peanut Butter	2 tbsp	7.6
Black Beans	4 oz	7.5
Sunflower Seeds	¼ cup	6

Protein

It is important to start your little learner's day with a complete protein to support mental alertness and brain function.

Protein comes from the Greek word protos, meaning first. Proteins supply the necessary amino acids to build and rebuild organs, muscles, antibodies, hormones, enzymes, and neurotransmitters that affect brain performance. Neurotransmitters are biochemical messengers that help the brain function properly. There are two types of amino acids found in protein that affect neurotransmitters:

Neurostimulants such as proteins containing tyrosine, affecting the alertness transmitter's dopamine and norepinephrine.

Calming proteins that contain tryptophan, the precursor to the neurotransmitter serotonin, which has a relaxing effect on the brain.

Some 60 neurotransmitters have been identified and the following are of particular concern for learning:

- **Dopamine** controls arousal and motor control in many parts of the brain. In the frontal lobes dopamine controls the flow of information from other areas of the brain. Dopamine disorders in this region of the brain can cause a decline in memory, attention, and problem-solving. Reduced dopamine concentrations in the prefrontal cortex are thought to contribute to attention deficit disorder.
- **Serotonin**, known as the "feel good" neurotransmitter, can have a profound effect on mood, anxiety levels, and aggression.
- **Acetylcholine** controls activity in the brain areas connected with attention, learning, and memory. Acetylcholine is a neuromodulator enhancing communication between neurons. (Deficiencies in the brain have been associated with Alzheimers disease.)
- **Norepinephrine** induces physical and mental arousal and elevated mood. It also plays a large role in attention and focus.
- **Glutamate** is vital for forging the links between neurons that are the basis of learning and memory. It is the most abundant and fast excitatory neurotransmitter in the nervous system. It increases neuronal efficiency as it increases the firing of neighboring axons (primary transmission lines of the central nervous system).

Nine of the 20 amino acids found in protein must come from the diet and are considered indispensable. Protein sources such as meat, poultry, fish, eggs, milk, cheese, and yogurt provide all nine indispensable amino acids in adequate amounts and for this reason are considered a "complete protein." Proteins from plants, legumes, nuts, seeds, and vegetables tend to be deficient in one or more of the indispensable amino acids and are called "incomplete proteins."

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five percent of the recommended daily intake (RDI) of each of eight specified nutrients per serving -- protein, vitamin A, vitamin C, niacin, riboflavin, thiamine, calcium, and iron.

An acceptable (5 percent RDI) trail mix granola bar has 0.4 mg of iron and 3 grams of protein. A quarter cup of pumpkin seeds has 4.2 mg of iron and 15 grams of protein. (The daily recommended requirement of iron for preschool and kindergarten children is 7-8 mgs, and protein, 20-50 grams a day.) Schools could certainly become pro-active in offering foods with abundant instead of minimally nutritious snacks. This could make the difference between a child eating recommended dietary intakes of specific nutrients and going to sleep with hungry red blood cells and neurons.

Raising your children's nutrient quotient will increase their intelligence quotient

By taking advantage of Mother Nature's multivitamin and mineral supplement inherent in unprocessed foods born of the earth, parents and teachers can up the ante in every bite served to children at home or at school. Everybody wins!

- **Parents** - Children come home from school happier, healthier, and wiser.
- **Teachers** - Children are more focused, better learners, and even tempered.
- **Children** - Improved attention, improved learning, improved health and mood.

Added bonus for relatives, caregivers, and airline passengers

Eliminates your children from their gossip and grudge list.

School challenge: Take up the slack. Ensure all of your children are eating nutrient-rich, fresh, perishable foods consistently. Get rid of the vending machines!

In fact, several schools require that during the school day, only full meals and individually sold portions of nuts, nut butters, seeds, eggs, cheese packaged for individual sale, fruit, vegetables that have not been deep fried and legumes are sold. There's hope.

But also concern: A few states considered taxing foods and beverages with minimal nutritional value and directing the revenues to school facilities or childhood obesity prevention. (I had to read this one twice.)

Grrrr. Be relentless in your efforts to implement change with your 100 percent knowledge of nutrition basics, especially if you are struggling with dietary changes yourself. Our children deserve more than half measures.

People who love children change the world by teaching them how to eat.

Nutrition Basics

Congratulations! You are about to become well informed and ready to ruffle a few feathers (free range, of course) and shake a few trees and vines, tumbling fresh, organic produce on to our collective tables.

Please read this chapter several times and become familiar with the different components of the foods we eat, their specific jobs, where they are found, and the subtle variations in their preparation that can impact the brain function and behavior of children.

Please read this chapter several times and become familiar with the different components of the foods we eat, their specific jobs, where they are found, and the subtle variations in their preparation that can impact the brain function and behavior of children. This newfound expertise will enable you to become a facilitator of your own child's healthful meal and snack planning and also enable you to hop on board as a consultant to your child's school wellness program. If they don't have one I implore you to initiate one. (If not applicable, begin at home.)

Recent legislation enacted by the federal government is asking our academic communities with reimbursable lunch programs to devise strategies to improve the nutritional status of the foods being offered and served to children at school.

The Local Wellness Policy Act states that beginning in the 2006 school year, parents, students, school administrators and the public come up with a school wellness policy that includes goals for nutrition education and physical activity, as well as school-based activities designed to promote student wellness -- including nutritional guidelines -- with healthier, slimmer students in mind.

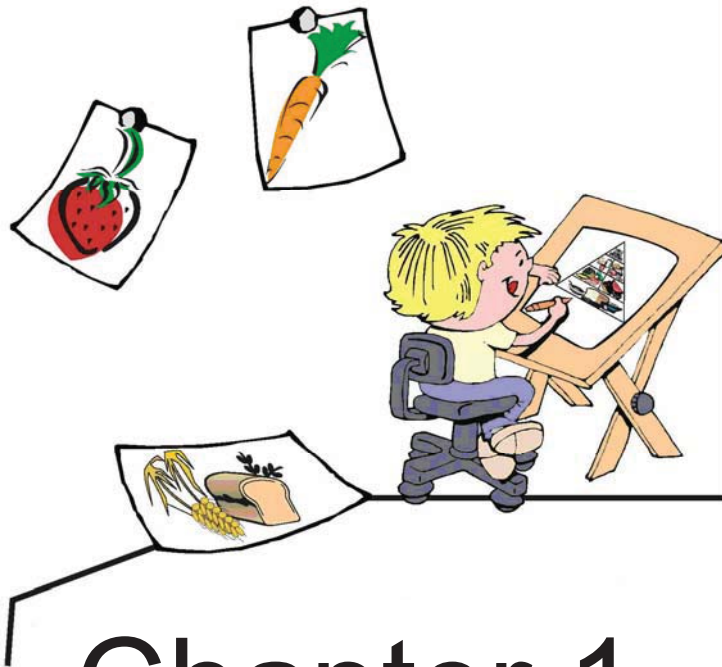
In general, the Secretary of Education in consultation with the Secretary of Health and Human Services, acting through the Centers for Disease Control and Prevention, will support individual schools with technical assistance and best practices. (If you are feeling confused as to who will be in charge, I am too.)

A "watchdog" is to be appointed from the local educational agency or school, making sure each school is operationally responsible. I am appointing you to become your own nutritional "pit bull." Paramount to any Local Wellness Policy involving children is the need to know and understand the specifics of "feeding the brain," not just the body. If I were running the show, it would be Policy for Nutritional Education, with its emphasis on macro- and micronutrients for brain development and function for every person involved in the life of a child or child-to-be. (But -- that's just me.)

Another reason to become a nutritional "pit bull" is the vending machines-at-school debate. Some states feel that calories should be limited to between 150 and 200 per packaged offering. Hmm. I don't know about you, but when I was in school, I could easily eat several packages of sweet and salty crunchables. A handful of states are suggesting our children be healthy half of the time by mandating that all vending machines on state property, at a minimum, offer food and beverages that meet 50 percent of the acceptable nutritional guidelines. These acceptable guidelines include a food which provides less than

Nutrition For Learning

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Chapter 1

Nutrition Basics

determine the causes for nutritional effects that plague little and big learners behaviorally. I see now that these problems were precipitated by a lack of vital nutrients needed for healthy brain function. Every child wants to learn. Having the proper nutrients to focus and attend is truly a science whose time has come. Mothers-to-be hold the tastes of the foods that could determine their newborns future intelligence.

Miss Jan

¹Reference upon reference is available throughout this book.

controlled studies, and dissected under the microscope. The influence of the research findings¹ on our children is sobering.

1. Children who eat more French fries than asparagus reverse letters while learning to read and mice fed trans fatty acids struggle through a maze with reversal learning disabilities.
2. Children who come to school eating breakfast “on the run” are full of added sugar while scientists have identified a child’s physiological response to sugar to be 10 times that of an adult.
3. Glow-in-the-dark confections line bakery shelves while studies indicate irritability and restlessness in children who eat tartrazine (yellow food dye #5) and laboratory mice fed red food dye are spawning offspring with chromosomal damage.
4. Infants from all socioeconomic backgrounds are being born malnourished and scientists have identified fetal adipose tissue programmed for later “catch up” obesity, putting them at risk for diabetes.
5. Babies are born deformed, with preventable mental disorders or low birth weight (with a high risk of brain damage), and researchers consistently identify maternal deficiencies of vital nutrients from whole unprocessed foods (born of the earth and sea).
6. Fetuses are growing from embryonic cells that will genetically predispose them to DNA damage while oncology researchers are discovering the protective effect that 12 servings of fruits and vegetables a day (in utero and until the age of two) have against infant and childhood cancers.

Some little learners never make it to preschool. Others make it into preschool and turn into bigger learners who join the rising numbers of learning-disabled children embedded in special education programs nationwide. According to the 2003 Summary of Health Statistics for US children, learning disabilities are amassing diagnostic numbers close to 5 million annually. (Did I mention that reading failure plagues 80% of the learning disabled?) Autism is now reaching epidemic proportions.

At the round table where the fate of many children is decided by recommendations from teachers, school administrators, remedial specialists and health professionals, children are getting left behind anyway.

Until a child’s performance assessment includes a dietary intake form which includes typical meals and snacks eaten daily, added sugar, and dietary fat intake (not just for added calories but for brain function) we must take matters into our own hands and educate ourselves. (This includes nutrient-specific guidelines for couples prior to conception and for mothers-to-be throughout each trimester of pregnancy.) Foresight cancels out hindsight!

If you think that you are already feeding your child with the utmost of consciousness, you probably are. However, in the words of holocaust survivor and family friend Harry Spitz, “There’s always room for improvement.” When I see an entire classroom change from sufficiently engaged to positively grounded in activity just by adding another $\frac{3}{4}$ cup of walnuts to the oatmeal-cookie oatmeal, I find that proteins feed the brain better when they are complete and no amino acid -- or child -- gets left behind.

I would be negligent if I didn’t prioritize the general health of the newborn and the effects of the mother’s nutritional status first and foremost as the goal of this book. Nutrition for Learning began as a quest to

Little did I know that I was also about to uncover the additional powers of these various nutrients and patterns of eating that not only support the development and functionality of the brain but are also scientifically evidenced to lower the risk of infant and childhood birth defects, cancers, and even childhood obesity (more to come). All of this fascinating information was gleaned from the ongoing research, clinical findings and journal publications of a vast network of nutritional investigators with an “eye of genius” for nutrition and health. What really sealed the inevitability of our camaraderie, partnership and dual purpose was a visit to London and participation in the Generating Healthy Brains meeting co-sponsored by the McCarrison Society (whose focus is on nutrition and health) and the International Society for Prenatal and Perinatal Psychology and Medicine (ISPPN). In light of the 2005 European Brain Council’s press release on the cost of brain disorders amounting annually to 386 billion Euros in 2005, experts from around the world assembled to share their research findings as they apply to brain development and subsequent mental health.

As a Montessori teacher and hunter-gatherer in the field of nutritional science and subsequent brain performance, I selfishly hopped on a plane to the UK to glean from the research findings of the world’s greatest nutritional scientists and come back to the US with the keys to the kingdom - the formula for nutritional/academic success.

There is a clinical axiom invented by the scientific community that states, “When two scientists agree 95% of the time, you don’t need one of them.” So what did 14 research scientists from England, Germany, Denmark, Italy and the US agree on 95% of the time? Several things:

- The mounting scientific evidence of the enormous influence of genetics and the maternal diet prior to conception and throughout fetal development.
- The impact of nurture (including mom and dad’s relationship during pregnancy) affecting brain development and childhood behavior.
- Overly processed foods (manufactured fats, rendered proteins, and refined carbohydrates) void of essential nutrients, and their correlation with the rising levels of children’s mental and physical ill health.

From the podium, I spoke of the characteristics of “limited” (difficulty concentrating, behavioral problems) and “unlimited” (focused, joyful) learners, their dietary core foods and also how quickly “limited” learners respond favorably to healthier dietary changes, particularly when extra long-chained fatty acids are included.

Call it “the classroom meets the laboratory,” in the words of research scientist and conference chair, Professor Michael Crawford. “It was so special for us to have you help bring realism to the conference,” he told me, and from a teacher’s perspective everything that I heard at the conference crystallized all that I had observed over the years regarding nutritional and emotional influences and the child’s ability to function in the classroom.

And so, the realism between nutritional scientists and everyday people like you and me continues. As a society our eating habits, health and behavior are being measured in cohort and double-blind, placebo-

Introduction

Spewing yogurt onto his placemat while amplifying his “inside voice” beyond recognition is not behavior typical of Wyatt. And bullying and biting his best friend twenty minutes after arriving to school is certainly not characteristic of Maxie.

When focused, even-tempered Ellen came to school portraying an easily distractible, hysterical child who couldn't follow the simplest of directions, I began to ask myself, “Are little children just naturally moody and impulsive? Is their educability just a crapshoot dependent on the barometric pressure or the day of the week?” Thoroughly frustrated and exhausted, I decided to do a little investigating. I heard my Montessori teacher/trainer's words echo in my ears over and over again - the mantra of the Montessori teacher, “follow the child, follow the child.”

Maria Montessori, an Italian doctor and educator who opened her first Casa Dei Bambini (Children's House) in 1907 was an investigator and educational scientist with an “eye of genius” for child development. In fact, she introduced an entire methodology for educating children through every plane of development from infancy through university age.

Surely I could draw upon that “eye of genius” that was such an integral part of my Montessori accreditation. As a student I was required to spend hundreds of hours observing the behavior of infants and children and take detailed notes. Watching an infant for four hours and documenting his every move, gas bubble, and facial expression was no easy task but skillfully re-aligned my rushed adult perspective to a time when life happens in snapshots and little eyes are fixated on the moment with total presence and responsive innocence. I was determined to identify any and all obstacles that might be corrupting that focus and innocence. And with my students a reasonable place to start was breakfast.

I began my detective work mid-mornings, calling moms and dads as I searched for the faintest preschool dietary clue as to why certain students were attached to the classroom materials by 9:30 AM and others needed the tranquilizer gun. Rummaging through every child's lunch box, I went undercover, leaving no container or juice carton unturned. In extreme cases, I sniffed and tasted odd-colored “thing-ables” that could not be identified as animal, vegetable, dairy, grain or belonging to any food group for that matter.

I handed the evidence over to several local nutritional gurus. It became clear that the underlying principle that could be playing a significant role in my students' occasional or habitual emotional outbursts could be inconsistent and improper nutrition.

But, just to make sure, I also perused the books and periodicals in the library. I researched scientific literature and read everything I could find about early childhood education and nutrition as it applies to the little (and big) learner's mood, behavior, and ability to focus. Though intimidated at times by scientific language such as *the blood brain barrier* and *reduced neuronal phospholipid turnover*, when I came upon the phrase *carbohydrate addiction and brain fog*, the language barrier dissolved immediately. This germinal moment inspired countless hours of research, exploration and inquiry into specific nutrients and patterns of eating that could be affecting my students' ability to focus and learn.

obtained from sea foods such as mussels, oysters, crabs, and crayfish. Later in pregnancy the need for essential fatty acids for brain growth and development is important (fish and seafood again).

Jan has brought these matters to the attention of the public at a time when the nutrition and health of the mother, and the nutrition and health of the brain, are largely ignored. Consultations in Rome by the FAO (Fats and Oils Expert Committee) and WHO (World Health Organisation) have drawn attention to these matters as early as 1978. The House of Commons Select Committees on child health and on maternity services have also drawn attention to the threat of poor maternal nutrition, low birth weight and its associated high risk of mental impairment and chronic ill health in 1988 and 1991. No action! In 1972 I predicted that mental ill health and brain disorders would rise in the wake of the previous rise in heart disease. In June 2005, the European Journal of Neurology devoted to an audit of the cost of brain disorders. At 2004 prices, brain disorders have overtaken heart disease as the number one burden of ill health. The cost for the 25 member states of the EU (European Union) is 386 billion Euro dollars.

In summary, Jan has done an important service in this wonderfully instructive book. She has delivered an important message for the present and especially for future children yet to be born. In a very readable manner, she has brought to our attention the importance of maternal, infant, and childhood nutrition and the need to refocus our attention on brain growth and maintenance. The brain is the biological attribute that makes us different from other animals and makes us truly human.

Michael A. Crawford, PhD. CBiol, FIBiol, FRCPath.

Breast feeding is not only the best mental and physical nutrition for the baby but also the best way for the mother to lose the stored fat and regain her figure!

The essential fatty acids are not alone; there are many accessory micronutrients needed in support. Trace elements such as zinc, manganese, copper, iron, and iodine are vital both for utilisation and to make the enzymes that protect against peroxidation. Nature does not rely on just one or two anti-oxidant vitamins, such as vitamins C and E, but builds her own anti-oxidant protection systems which contain metals that can handle oxygen.

Similarly, folic acid and B vitamins are also essential for utilisation. You very often hear health organisations talking of the importance of folic acid. However, food is a whole package, not just one nutrient or another.

The brain first evolved in the sea using marine nutrients. It still uses the same marine nutrients today. So there is now an evidence-based truth in the old story that fish is good for the brain!

As early as 1973, we showed that primates deprived of the omega 3 fatty acids suffered from severe behavioural problems. This brings me to the point of how possible it is to correct behavioural problems and learning difficulties in children and even prevent dementia in the elderly. There is increasing evidence that maternal post-natal depression is worse in the countries where people eat little fish. There are studies in depression showing that benefits can be obtained from supplements of fish oils or docosahexaenoic acid (DHA is the main omega 3 fatty acid in the brain's signaling systems of fish, reptiles, amphibia, birds, mammals and humans). Similarly, the study on school children in Durham, England showed remarkable benefits in reduction of attention deficit disorders, improved learning and better mood control. The big challenge now is Alzheimer's disease.

The problem with age is that the brain relies on recycling its own materials. During activity in the day, the photoreceptors and synapses wear out and have to be rebuilt. However, no recycling process is 100 percent efficient. Although the adult brain does not grow new brain cells, it requires a continual topping up of the essential ingredients needed to rebuild the synapses and cellular materials. Again, there is good epidemiological evidence that the fish-eating nations like Japan have less Alzheimer's disease than do we in the US and UK. Even in Cuba, where, despite being an island, they eat very little fish, the incidence of Alzheimer's disease is very high.

Moreover, a major clinical trial in Italy (the GISSI trial) reported that fish oils at about 0.75g/day of the omega 3 essential fatty acids resulted in a sharp decline in mortality from sudden death (heart failure) and causes such as heart disease and cancer. Vascular deterioration is also a cause of decline in brain function and of course stroke. Again, to feed the huge demand for energy and nutrients for brain growth in the fetus, a good vascular system and blood flow is vital, so vascular and mental impairment are linked.

Mom can ensure a good blood flow before and during pregnancy by eating a good diet with the right kind of lipids or fats and micronutrients. In the early part of pregnancy, embryonic development focuses on the heart and then the placenta grows -- all preparing for the last trimester when the fetus and brain grows. Iron is important at the beginning (very lean meat and occasionally liver/kidneys provide this), iodine and trace elements become important to protect the brain, and these are best

Foreword by Professor Michael A. Crawford

Last century the focus of nutrition was on protein and body growth. “Johnny, drink up your milk or you won’t grow up to be a basketball player” was a common cry of the mother imbued with the wisdom of the day. Government and United Nations committees were forever recommending how much protein was needed for Jeanny and Johnny to grow. The balance of amino acids in a protein was considered vital and protein quality was determined based on the growth rates of rats.

Now we know that protein is important for body growth. You can see this in the rhinoceros, which gets all the protein it needs from the simplest food resource, namely grass, to inflate to a 1-ton bodyweight in four years after birth. The only problem it has is that to serve this massive body, there is only three-quarters of a pound of brain.

Much of the nutritional message of the last 50 years was derived from the excellent research on farm animals, where weight gain and body growth was the keynote to profit. However, compared to the rhinoceros neither Johnny nor Jeanny matched the growth of one of its legs by four years of age. The difference between our children and the rhinoceros is the brain. While the rhinoceros only achieves three-quarters of a pound of brain in four years, after which it does not get any bigger, our children have close to three pounds of brain at four years of age.

So there are different principles for body growth and brain growth. The body has a high protein content and so we need protein for body growth. The brain has a high lipid content (60 percent of its building materials). Just as we need essential amino acids which we cannot make in the body to build protein, so we also need to eat essential fatty acids to build the lipids for the brain. Quite frankly, our children need these essential fatty acids more than they need protein. This fact is reflected in the composition of human milk compared to cow’s milk, a fast-growing mammal like the rhinoceros. Cow’s milk contains four times the amount of protein compared to human milk, but human milk contains 10 times the amount of the very exact type of long chain essential fatty acids specifically used in brain growth.

Jan has written a wonderful book which communicates these messages about the importance of the nourishment of the mother and child to serve the proper needs for brain development. The child is born with some 70 percent of the adult number of brain cells. The rest are put in place shortly after birth encouraged by the nerve growth factors and the specific essential fatty acids in the mother’s milk. So the nutrition of the mother in preparation for pregnancy and during pregnancy and lactation is paramount. It is interesting how nature prepares in advance of the important phases of brain growth. Women who become anorexic or are on high-powered athlete’s training often cannot get pregnant. The body has a mechanism whereby it will not let it happen unless the mother is in a fair nutritional status with adequate fat/lipid stores. Although brain development and growth are powerfully protected by nature, inadequate nourishment can cause irreversible damage.

Lipid is just a technical jargon for the types of fat that are used in cell membranes. During pregnancy, the placenta develops ahead of the fetal growth spurt in the last months in order to ensure an adequate blood supply. When the baby is born, the well-nourished mother will have gained about nine pounds of fat, which will guarantee one-third of the cost of breast feeding over the first 100 days.

We then demonstrated the essentiality of omega-3 fatty acids in a primate. This study also was the first to demonstrate a link between omega-3 deficiency and behavioral pathology.

Fiennes, R.N.T. W., Sinclair, A.J., and Crawford, M.A. (1973) Essential Fatty Acid Studies in Primates: Linolenic Acid Requirements of Capuchins. J. Med. Prim.2: 155-169

I later sealed the requirement for omega-3 fatty acids.

Budowski, P., Hawkey, C.M., and Crawford, M.A. (1980) L'effet Protecteur de L'acide Alpha-Linolenique sur L'encephalomalacie Chez Le Poulet Ann. Nutr. Alim.34: 389-400

And the need for a balance between omega-6 and omega-3 fatty acids in studies in collaboration with Professor Pierre Budowski of the Hebrew University of Jerusalem.

Budowski, P., Leighfield, M.J., and Crawford, M.A., (1987) Nutritional Encephalomalacia in the Chick: An Exposure of the Vulnerable Period for Cerebellar Development and the Possible Need for Both W6 and W3 Fatty Acids. Br. J. Nutr., 58: 511-520

The rest is more history.

An Interview with Professor Michael A. Crawford

In the earlier years of his career (1960) as a research scientist Professor Michael Crawford joined the medical school in Kampala, Uganda to set up biochemistry teaching and chemical pathology for the new Mulago Hospital built by the British in advance of independence. His subsequent research helped the East African medical community uncover the nutritional causes of many life threatening ailments such as Tropical Heart Disease which could be correlated to a protein and essential fatty acid deficient diet, primary liver cancer which was traced to aflatoxin, a liver carcinogen in the local diets, and bladder cancer which was prevalent in certain pockets in South Africa due to high concentrations of ortho-amino-phenols found in a diet high in plantains and similar foods.

In the late 1960's Professor Crawford changed his research focus from protein malnutrition in Africa to lipid malnutrition in the West. Curious about his motivation for this change I asked him the following:

After reading about your research background specifically your change in focus from the effects of protein malnutrition in Africa to the lipid malnutrition of the West, I'm curious to know if there was a single event or series of events that impassioned you to begin researching essential fatty acids and brain development. It appears that many of the researchers in the 1960s (Hugh Sinclair, for instance), focused on essential fatty acids and their relative deficiencies causing non-infective Western diseases such as coronary heart disease.

Professor Crawford:

Working in endomyocardial fibrosis in Kampala at Makerere University College Medical School (not coronary heart disease but cardio-myopathy) the results told me that you needed both protein and fats to make cells. Really started from there – lipids AHA brain, etc.

I was curious to know why different animal species had different sized brains. Seemed important to know as the brain is Homo sapiens most important attribute and everyone else seemed captivated by growth. However, all the big land animals had smaller and smaller brains as their bodies evolved faster growth rates and bigger body sizes.

Surrounded in Africa by nature's last great experiment in mammalian evolution that seemed an important question. The lipids (fats) came into it when I realized that the brain material is 60 % lipid. It did not take long to realize that the big small brained animals meant that different principles were involved in body growth and brain growth (protein and lipids).

So I hired Andrew Sinclair from Australia. He was one of the very few biochemists at that time (1960s) with experience in and an interest in lipids.

The rest is history starting from our publication in 1972 which was the first to show that arachadonic (omega-6) and docosahexaenoic (omega-3) acids were determinants of brain growth and function.

Crawford, M.A. and Sinclair, A.J. (1972) The Limitation of Whole Tissue Analysis to Define Linolenic Acid Deficiency. J. Nutr. 102: 1315-1321

lists, food plans and recipes that incorporate these essential nutrients into meals daily. Dr. Simopoulos contributed several articles for this book including; Workshop on the Essentiality of and Recommended Dietary Intake for Omega-6 and Omega-3 Fatty Acids, Declaration of Olympia on Nutrition and Fitness. 28-29 May 1996, Ancient Olympia, Greece. She also answered important questions via personal communication throughout the writing of this book.

When I was researching brain nutrients I came upon the Grand Forks Human Nutrition Research Center which is operated by the United States Department of Agriculture and the important work of Dr. Forrest Neilson regarding boron and its vital role in neurological functioning. Dr. Neilson responded to my requests for information and sent me booklets on trace minerals and scientific papers on boron which he has extensively researched and determined to have a daily recommended intake. (Subsequently, he has also shown that boron enhances the effects of omega-3 fatty acids for eye and brain development.)

I was invited to speak at the International Montessori Council's Peace Academy several years ago and I chose the topic - nutrition for learning and shared everything I had researched up until then which in retrospect was probably enough to fit on the head of a thumbtack. When I returned home I planted myself in my office with resource, reference books, and scientific studies sitting as tall as I was - on the floor and every desk and table top in my office. Margot Garfield-Anderson who is the event coordinator and book shelf manager of the Montessori Foundation wrote to me after the conference and told me that several schools knew I was writing a book on supportive nutrition for learning and were preordering the book. She immediately rallied the Montessori Foundation headed by Tim Seldin and began PR for Nutrition for Learning before I had two chapters finished. Margot also proofread and critiqued every chapter upon completion. Her support and vision to follow through with this project and persistent heckling to make sure I was on track goes beyond kindness. It was a genuine Mitzvah! You see Margot, I really was writing, writing, writing.

Monica Guerrero tirelessly formatted and edited the text and shared her personal challenges and victories with me regarding her beautiful five-year-old daughter, Nahnah. It was something greater than chance that Monica's great talents as a book designer and my interest in supportive nutrition for learning would create a partnership that added a texture and chapter to this book, Prescription for Change that might not have evolved otherwise.

My husband, Joe, made wonderful dinners for me every night and worked on crossword puzzles so I could continue to write into the evenings. He also reminded me to sit up straight when I was slouched over in front of the computer. I especially want to acknowledge him for listening through my excitement and disappointment as I completed yet another research session and also for not buying products that contain carreegeenan.

I'd like to acknowledge all of my students and their families over the years for the snapshots of humanity they've contributed to my life and also inspiring me to stop complaining about the darkness that comes from unhealthy eating and light a candle. And so, I acknowledge myself for writing this book and you, dear reader, for accompanying me on my journey of nutritional discovery.

Acknowledgments

I would not have had the confidence to delve into this highly technical field of nutritional science without the continual encouragement to “keep going” from Professor Michael Crawford, Director of the Institute of Brain Chemistry and Human Nutrition at the London Metropolitan University.

In the late 1960’s Professor Crawford, an Internationally acclaimed nutritional scientist, changed his research focus from protein malnutrition in Africa to lipid malnutrition in the West. His subsequent research and discovery of essential fatty acids (omega-3 and omega-6) in brain growth, and function won him several Gold Medal Awards along with many crucial roles as an International consultant helping to develop infant formulas, advise the world on dietary fats and oils in human nutrition, and spearhead present and future research to prevent or treat neuro (low birth weight babies, Down’s syndrome) and other developmental disorders such as diabetes in the unborn fetus, newborn, or young child.

How did I, a Montessori preschool teacher and author living in Phoenix, Arizona befriend Professor Michael Crawford who lives thousands of miles away? It was easy. He was one of the experts in essential fatty acids and brain development whose research I was studying for Nutrition for Learning.

I emailed Professor Crawford who immediately took an interest in my research project and shared with me important information and studies that I devoured to gain a working knowledge of the ubiquitous role of essential fatty acids particularly DHA (docosahexaenoic acid) in the neurological health of my students. In fact, he took a personal interest in several of my students who were struggling in school and recommended cod liver oil supplementation which made a steady and profound difference in their learning, behavioral, and social abilities.

Words cannot express my appreciation to him for answering questions contained in emails that I fired out sometimes daily and always corresponding with me as if I were a colleague - well-versed in lipid chemistry (little did he know that I referred to many scientific dictionaries and journals for definitions and still cannot pronounce docosahexaenoic acid).

Michael’s knowledge and dedication to the power of preconceptual nutrition encouraged the scientific piece; The Declaration of Nutrition, Health, and Intelligence for the Child-To-Be, which is in the final chapter (It Takes a Village) of this book.

Nim Barnes, founder of Foresight preconceptual care contributed her time and literature so I could fully understand the impact of nutrition and environmental influences on the viability of ovum and sperm. While traveling to London for Foresight Practitioner training, Nim not only invited my husband and I to stay at her beautiful home in Bognor Regis, West Sussex – she tirelessly shared her life’s work and sent me back to the US with books, videos, and pamphlets so I can begin to help couples in the U.S. preparing for pregnancy.

I reached out to many nutritional scientists and experts in the field of human nutrition as I plowed through study after study. Dr. Artemis Simopoulos, Director of Genetics, Nutrition and Health Services in Washington, D.C. and the author of The Omega Diet emailed me with great interest in this project. I refer to her book almost daily and continue to recommend it to anyone who wants to fully understand fats and oils and the relationship between omega-3 fatty acids and overall health. Her book includes shopping

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Nutrition For Learning – Feeding The Starving Brain

By Jan Katzen-Luchenta

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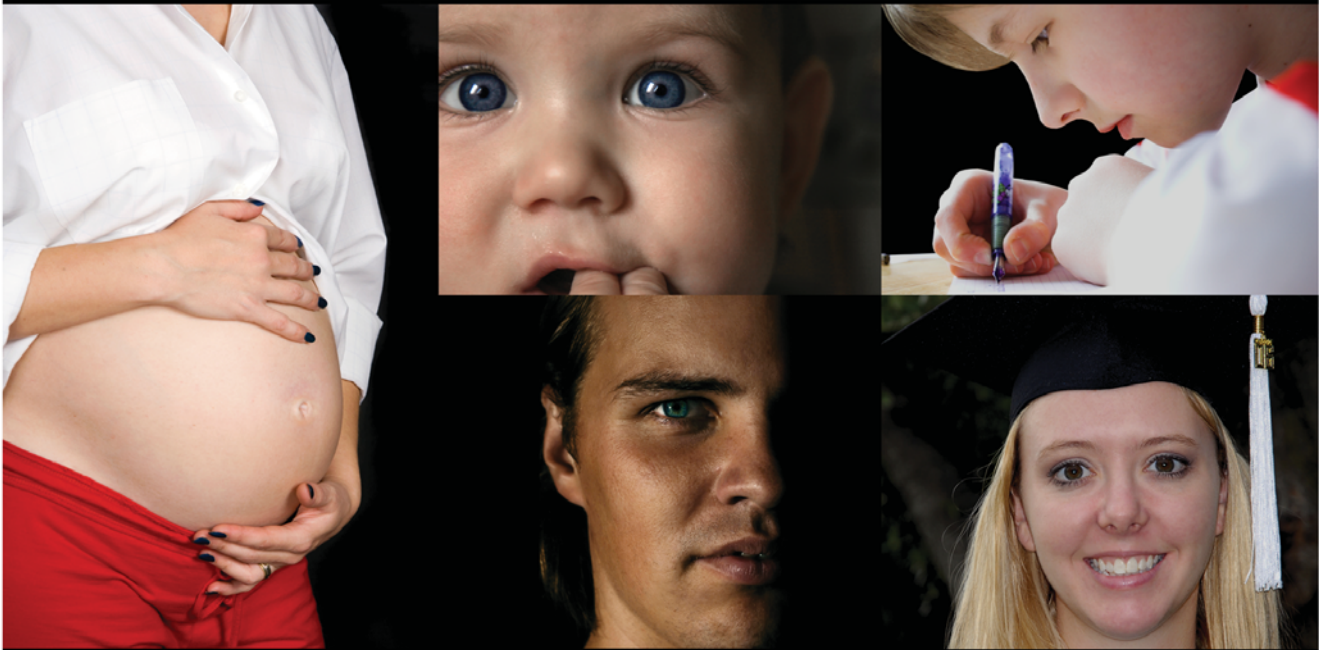
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Disclaimers

The children, teachers and parents described in this book are fictional composites. Any resemblance to living persons is unintentional and accidental.

The information provided within this book is provided for educational purposes only and should not be used as a substitute for a consultation with your physician, nutritionist and other health care providers.

Feeding The Starving Brain



Nutrition For Learning

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