What Kids Need to Eat

A scientific approach to optimizing children's mental and physical health through diet

Aileen Burford-Mason PhD

"If the aim of the Guide is to protect health and to reflect our best understanding of the impact of diet on chronic disease, then the Guide is failing miserably ……

Professor Dr Yoni Freedhoff MD
Dept. of Family Medicine, University of Ottawa
Quoted in the Globe and Mail 27th April 2015

"….woefully phobic of saturated fats; almost wholly ignorant of sugar; strangely in love with dairy; insufficiently cautionary on processed meats, ultra-processed foods and eating out; and bizarrely supportive of the notion that juice and fruit are one and the same.

Professor Dr Yoni Freedhoff MD
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Food is essential…

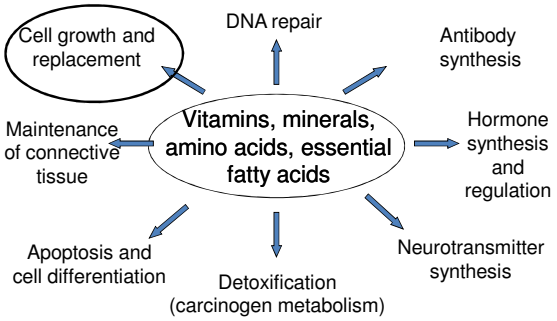
- It contains 40 or so different elements all of which are necessary for life – the essential nutrients:
  - All the vitamins
  - All the mineral
  - Two types of essential fats
  - 9 essential amino acids

- If it wasn't in food it isn't in the body
- Most kids habitually eat deficient diets
  - Missing some of these essential ingredients

Food provides raw materials for replacement and maintenance of

- Cells
- Bones
- Connective tissue
- Hormones *(insulin, thyroxin, estrogen, testosterone, etc.)*
- Neurotransmitters *(serotonin, dopamine, acetylcholine, etc.)*

Daily Metabolic Requirement for Nutrients



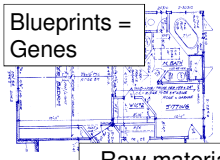
"Normal apoptotic cell removal and cell replacement in tissue remodeling is estimated at some 1 X 10^{11} cells per day - equivalent to the turnover of an adult's total body weight every 18-24 months."

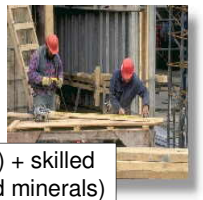
APOPTOSIS. Israels LLG, Israels ED
Stem Cells 1999: 17(5):306-13

Cell Growth and Replacement
Children vs. Adults

- In adults, cells divide and grow on a regular schedule
  - Fast turnover in bone marrow, skin and gut cells
  - Most other cells are resting or slow growing
- In childhood cells multiply faster
  - Birth to age 2: rapid but decelerating growth
  - Age 2 yr to onset of puberty: slow growth phase
  - Teenagers: rapid growth or growth spurts
- All this growth must be fueled with good nutrition!

Blueprints = Genes





Raw materials (food) + skilled workers (vitamins and minerals) BOTH needed to build a house

Quality of finished product depends on the quality of raw materials used and the workmanship

Chemicals in vegetables and fruit detoxify – they switch on genes in liver needed for elimination of natural or synthetic toxins

These same chemicals protect - they are natural antibiotics and antioxidants

Growing children, hungry brains

- Early childhood: physical growth slows but the brain grows faster than at any other stage of life
- Compared to other mammals human childhood is very prolonged
- Scientists believe this is because the child's brain demands so much of its food resources
  - These include glucose for brain energy and the vitamins, minerals, essential fats and amino acids

Vegetables and Fruits

Not an optional extra!

Phytochemicals

Hi-jacking nature's pharmacy

- Phytochemicals are molecular constituents of herbs, spices, fruits, and vegetables
  - give plants their colour, smell and taste
- Not required for survival – but needed for good health
- They are the plant's defense against the threats of its environment
  - Microbes, oxidative stress, and toxins
  - When we eat plants we gain some of that protection

Phytochemicals

Phytochemicals:

- Support immune system: They are natural antibiotics, anti-viral and anti-fungal drugs
  - In the laboratory garlic is as strong an antibiotic as penicillin or erythromycin
- Antioxidants: Protect against sun damage and inflammation
  - the plants own sunscreen
- Detoxify: support the liver in its efforts to eliminate environmental and natural toxins

Food for thought: the role of dietary flavonoids in enhancing human memory, learning and neurocognitive performance

Spencer JP. Proc Nutr Soc. 2008 May;67(2):238-52

- Review article: shows how dietary-derived phytochemicals activate brain pathways pivotal for memory and learning
- Many diverse phytochemicals have the potential to:
  - improve human memory and neuro-cognitive performance
  - protect vulnerable neurons
  - enhance existing neuronal function
  - stimulate neuronal regeneration (i.e. after injury)

Fruits and Veggies (1)
How much is enough?

- Boys and girls: 2-3 yrs — 4 servings
- Boys and girls: 4-8 yrs — 5 servings
- Boys and girls: 9-13 yrs — 6 servings
- Teens 14-18 yrs
  - Girls — 7 servings
  - Boys — 8 servings

Note: Combined intake of vegetables and fruit per day

Source: Health Canada *www.hc-sc.gc.ca*

Fruits and Veggies (2)
What is a serving size?

- 1 cup of raw leafy vegetables
- 1/2 cup of cooked or chopped raw vegetables
- 1 medium or ½ large vegetable or fruit
  - Tomato, ½ avocado; pepper, orange, banana, etc.
- 3/4 cup of vegetable juice (V8; tomato, homemade)

Remember: for phytochemicals to be properly absorbed they must be accompanied by a little fat!

Glucose and Brain Function (1)

- Optimal brain function depends on a steady glucose supply
  - enhances learning and memory
  - prevents irritability
  - helps with anger management
- After eating a meal, glucose levels fluctuate
  - First they rise, then they drop and dip into the hypoglycemic range (low blood sugar)

Glucose and Brain Function (2)

- This effect is more pronounced after a meal or snack with a high sugar or starch content
- The resulting low blood sugar
  - interferes with focus, concentration and willpower
  - impairs learning and memory
  - Increases irritability

ADHD

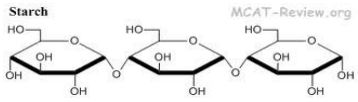
- Becoming more common:
  - Associated with learning disorders and poor school performance
- Incidence has increased in parallel with increased sugar consumption *[Postgrad Med. 2011; 123(5): 39–49]*
- Children with ADHD are easily distracted, unable to focus, impulsive, emotional
- ADHD usually persists into adulthood

Attention-Deficit/Hyperactivity Disorder: Is it Time to Reappraise the Role of Sugar Consumption?

Johnson RJ et al. Postgrad Med. 2011 September; 123(5): 39–49.

- Background: Genetics do play a role in ADHD
  - However, genes account for only a small percentage of ADHD cases
- Review: Re-examines evidence that excessive sugar intake plays a major role
  - Chronic exposure to sweet tastes affects brain dopamine levels
  - This results in behaviours common to ADHD
- Effects produced either by sugar or artificial sweeteners

Remember that starch (bread, pasta, rice, potatoes, breakfast cereals, muffins, cookies, cakes, etc.) is simply sugar in disguise



Glycemic index and glycemic load

- Glycemic index (GI)
  - Ranks foods based on how high they raise blood glucose
  - Depends on rate of digestion and absorption
  - Refining, milling (particle size) makes starches easier to digest and faster to raise blood sugar
- Glycemic load (GL)
  - GI x carbohydrate content
  - Some foods may have a high GI but a low GL (i.e. watermelon).

Vegetables and Fruit
"Smart Carbs"

- Fruits, vegetables as well as minimally processed whole grains are digested slowly after eating
  - Provide a steady input of glucose to the brain from one meal to the next
- Do not send insulin levels soaring
  - Therefore should not trigger hypoglycemia
- Also provide critically important phytochemicals

"….. "You can have a bowl of corn flakes with no extra sugar added…..

David Ludwig MD. Professor of Nutrition Harvard School of Public health
Quoted in the Globe and Mail February 2013

"….. or a bowl of sugar with no extra corn flakes. It might taste different, but biologically they're comparable."

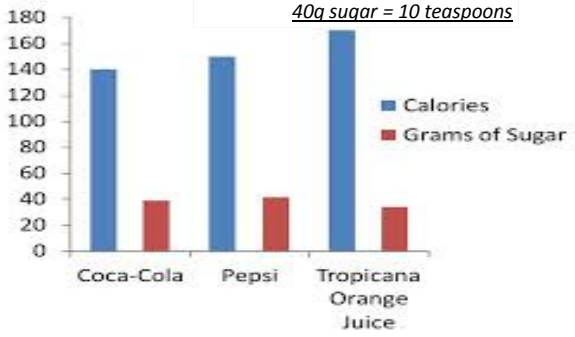
David Ludwig MD. Professor of Nutrition Harvard School of Public health
Quoted in the Globe and Mail February 2013

One cookie is never enough…

- Eating meals or snacks (*call them mini-meals*) with a high glycemic load sets the scene for carbohydrate cravings
  - A couple of cookies or a candy bar will cause sugar to rise rapidly
  - This is followed by a sudden drop as insulin rises
  - Then the brain signals it needs more sugar…
- Repeating this cycle over and over is a major risk for excess weight gain

Fruit Juice – liquid candy?

1 teaspoon of sugar = 4g sugar
40g sugar = 10 teaspoons



What's wrong with this breakfast?

- Cereal, toast and fruit juice
- Conforms to current healthy eating guidelines – 2 serving of grains, 2-3 serving of fruit
- Could provided from 300 to 750 cals.
- All carbs
  - equivalent to 68 cubes of sugar !

Why a Phytochemical-rich diet helps to curb appetite

- Most fruits and vegetables produce small amounts of natural toxins
  - Not a concern when the food is part of a varied diet and eaten in moderation
- At low doses plant-produced toxins are beneficial
  - They protect the plant from infection, weather, UV light, etc.
  - They also protect us from similar hazards
- A high intake of phytochemicals also signals us to stop eating in case of toxin overload

Protein is needed for…..

- Growth, tissue repair and maintenance
- To make hormones
  - insulin, thyroid hormones, sex hormones
- To make antibodies and other molecules of the immune system (interferon, etc.)
- To make neurotransmitters
  - Dopamine (for mood, focus and concentration)
  - Serotonin (for calmness, sleep)

Protein

- The body has little capacity to store protein
  - When the daily diet does not provide sufficient, muscles are catabolized to supply needed amino acids
  - Occurs within 1-3 days
- Note: the protein needs of the body remain the same during illness

Protein sources

- Animal sources
  - 1 sm. chicken breast = 30 grams
  - Med fillet of fish = 22 grams
  - 1 egg = 6 grams
  - 1 cup yogurt = 8-12 grams
- Vegetarian sources
  - Tofu ½ cup = 20 grams
  - Soy milk 1 cup = 6 -10 grams
  - Legumes/1/2 cup cooked = 7-10 grams
  - Almonds ¼ cup = 8 grams
  - Peanut butter 2 Tbsp = 8 grams

Protein from vegetarian sources

- Most vegetable sources of protein do not contain all 9 essential amino acids (incomplete)
  - need to eat a combination of foods to get the complete range
- Tofu and quinoa are complete. To consume complete protein from other vegetarian sources combine
  - Legumes + seeds
  - Legumes + nuts
  - Legumes + grains

How much protein does your child need?

- Take your child's weight in pounds and divide it by 2 to get the amount of protein they need per day in grams
  - an 80 lb child would need 40 grams of protein a day
- The protein should be roughly divided between all 3 main meals
  - Don't load it all into dinner and forget about breakfast!

Protein and Dopamine

- Protein provides tyrosine, the precursor molecule for dopamine
  - Antidepressant. Needed for focus, concentration, energy (physical and mental) and willpower
- Brain tyrosine rises quickly after eating rapidly digested protein – milk, yogurt, fish, poultry, etc.

Protein and Serotonin

- Protein also provides tryptophan, the precursor molecule for serotonin.
  - Tryptophan is an essential amino acid and the least plentiful amino acid in protein food
- Eating a protein-rich meal does NOT increase brain tryptophan
  - This is due to competition with other amino acids for transport across the blood-brain barrier
- Eating starchy foods (comfort foods) helps get tryptophan into the brain

High Glycemic Load

Bread, potatoes, rice, pasta
cookies, cakes, candy, ice cream, soda pop etc.

↓

Increases brain serotonin

↓

induces a sense of calm; screens out anxiety-producing stimuli

high potential for weight gain

low energy (sleepy)

↓

Decreased activity in the brain's frontal cortex

Dopamine and Serotonin
– a matter of balance –

Dopamine increases focus and concentration, while serotonin limits the amount of information the brain receives

Ideally, dopamine should dominate during the active or working part of the day, while serotonin levels need to rise in the evening

Effects of normal meals rich in carbohydrates or proteins on plasma tryptophan and tyrosine ratios

Wurtman RJ et al. Am J Clin Nutr. 2003 77(1):128-32

Compared 2 breakfasts of different compositions

Breakfast 1: high sugar/starch
Pancakes, syrup, OJ, coffee with sugar

Breakfast 2: high protein
turkey bacon, egg beaters, grapefruit sections, cheese, butter

- Insulin ↑ significantly after breakfast 1 but not 2
- High starch/sugar meal raised blood levels of tryptophan relative to tyrosine.
- Net effect of breakfast 1 would be
  - To increase brain serotonin, decrease focus and concentration; increase daytime sleepiness

Essential Fats (1)

- Two types of fat are essential: omega 3 and omega 6 fatty acids
- Docosahexaenoic acid (DHA) and Eicosopentanoic Acid (EPA) are both long chain omega-3 fatty acids
  - major structural fats of the brain
- Dopamine and serotonin receptors are composed mainly of omega 3 fatty acids

Why is fish important?

- Many of us do not convert linolenic acid (omega-3 from plant sources) into DHA and EPA very efficiently
- EPA and DHA are present (preformed) in fatty fish and fish oils.
  - Can also be obtained from algal supplements (vegetarians)

Omega 6 and omega 3 balance

what is the best ratio?

- Balance between omega-6 and omega-3 fatty acids should be in the range of 1:1 to 4:1
- Typical N.American diets provide ratios from 11:1 to 30:1
- The Mediterranean diet provides a more physiological balance compared to Western diets *(J Nutr. 2001 Nov;131(11 Suppl):3065S-73S)*
- Message: supplement *only* with omega 3s to correct this imbalance

What are trans fats ?

- Formed by processing liquid oils into solid fats. AKA hydrogenated or partially hydrogenated fats
  - Increases food's shelf life, flavour and stability
- Found in vegetable shortenings, some margarines, crackers, cookies, snack foods
  - Also found in fried foods
- There is no safe amount of trans fats

Essential Fats (2)

- If DHA is deficient, trans-fat molecules may be used in cell membranes instead
  - Trans-fats change the nature and function of cell membranes
- An omega 6 fatty acid, arachidonic acid (ARA) is equally important for brain development (babies)
  - Found in meat, eggs and milk
- Generally, diets contain too much omega 6 fat. Need to increase omega 3s

Durham Dyspraxia Trial
Durham Educational Authority, Durham, UK

- Dyspraxia: Difficulty drawing, writing, buttoning clothes or other tasks needing fine motor skills
  - Often co-exists with ADHD and dyslexia
- 100 children at 12 schools in Durham county given either fish oil or placebo capsules (RCT)
  - 12,000 assessments were undertaken over 1 yr
- Trial looked at Dyspraxia and Motor skills, but there were also full assessments for Dyslexia and ADHD

"The response has been very encouraging. In very broad terms, we saw that up to 40 per cent of children on the trial showed dramatic improvements.

In some individual cases, we saw reading age gains of between 18 months and four years, and attention gains of as much as 400 percent."

Dr Madeleine Portwood, Senior Educational Psychologist, Durham County

Circulating 25-Hydroxyvitamin D_3 in Pregnancy and Infant Neuropsychological Development. *Morales E at al. Pediatrics.2012;130(4):e913-20*

- Study: 1,820 mother-infant pairs studied
  - Mother's vitamin D levels tested in 1st trimester
  - Infants' mental and psychomotor scores assessed at 14 months of age
- Results: 52% of Mothers had either deficient or insufficient blood levels of vitamin D
  - Neurocognitive and psychomotor score were highest in infants where maternal vitamin D was above 40 ng/ml (100 nmol/L)

What Kids Need to Eat

- A high-protein diet: Include cheese, eggs, meat, fish, milk, yogurt, beans and nuts
  - to improve focus and concentration increase protein in breakfasts and after-school snacks
- Reduce or eliminate simple carbs: candy, corn syrup, honey, sugar, etc.
  - This will keep insulin under control
  - Avoid white rice, anything made from white flour

What Kids Need to Eat

- Make the bulk of meals "smart" carbs:
  - salads, vegetables and less sweet fruits: citrus, apples, pears, blueberries, kiwi, cantaloupe, watermelon, etc.
- Include more good fats: omega-3 fats
  - tuna (lite), salmon, trout, walnut, almonds and Brazil nuts, and olive oil

Note: Omega-3 fats may need to be given in supplement form

Quick Start Healthy Eating Plan

- 3 meals a day and 2 small snacks
- ¾ plate filled with fruits, vegetables and/or legumes
- Palm-sized serving of fish, chicken, meat, eggs, cheese or a cup of plain yogurt at each meal
- The same size portion of brown bread, rice, pasta, etc. No white stuff !
- Must contain fat (small serving)

Breakfast makeovers

- Remove: breakfast cereals (even wholegrain), muffins, waffles, pop tarts
- Replace:
  - Egg with wholegrain toast and 1 whole fruit or vegetable (tomato?)
  - Fruit smoothie with added protein powder
  - Omelette: Fill with vegetables and grated cheese
  - Greek yogurt and berries; sprinkle granola or nuts and seeds on top

How do you get kids to eat their vegetables?

- Eat yours: Kids take their cues from the adults around them
  - If their parents are picky about vegetables so will they be
- Hide them: Puree into smoothies, spaghetti sauce, soups, etc.
- Dip them: Prepare cut up celery, cucumber, peppers and cherry tomatoes
  - Leave in the fridge with bought or homemade dips for after-school snacking