

A role for supplements in optimizing health: the metabolic tune-up

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FROM ABSTRACT

An optimum intake of micronutrients and metabolites, which varies with age and genetic constitution, would tune up metabolism and give a marked increase in health, particularly for the poor, young, obese, and elderly, at little cost.

DNA damage.

Deficiency of vitamins B-12, folic acid, B-6, C or E, or iron or zinc appears to mimic radiation in damaging DNA by causing single- and double-strand breaks, oxidative lesions or both.

Half of the population may be deficient in at least one of these micronutrients.

The Km concept.

Approximately 50 different human genetic diseases that are due to a poor binding affinity of enzymes and can be remedied by feeding high-dose B vitamins.

Mitochondrial oxidative decay.

This decay, which is a major contributor to aging, can be ameliorated by feeding old rats the normal mitochondrial metabolites acetyl carnitine and lipoic acid at high levels.

Many common micronutrient deficiencies, such as iron or biotin, cause mitochondrial decay with oxidant leakage leading to accelerated aging and neural decay.

Abbreviations used:

ALC acetyl carnitine

LA lipoic acid

THIS AUTHOR ALSO NOTES:

There are 40 essential micronutrients (vitamins, minerals, and other biochemicals that humans require).

Classic deficiency diseases of these micronutrient such as scurvy, beriberi, pernicious anemia, and rickets are rare.

However, higher levels of these micronutrients are required to prevent "chronic metabolic damage" and degenerative diseases.

Reduced micronutrient intake “result in an increase in DNA damage (and cancer), or neuron decay (and cognitive dysfunction) or mitochondrial decay (and accelerated aging and degenerative diseases).”

“The optimum amount of folic acid or zinc that is truly ‘required’ is the amount that minimizes DNA damage and maximizes a healthy lifespan, which is higher than the amount needed to prevent acute deficiency disease.”

The requirements of the elderly for vitamins and metabolites are greater than those of the young.

The optimal intake of micronutrients and metabolites varies with genetic constitution.

“A tune-up of micronutrient metabolism should give a marked increase in health at little cost.”

“It is a distortion of priorities for much of the world's population to have an inadequate intake of a vitamin or mineral, at great cost to health, when a year's supply of a daily multivitamin/mineral pill as insurance against deficiencies costs less than a few packs of cigarettes.”

“The poor, in general, eat the worst diets and have the most to gain from multivitamin/mineral supplementation and improvement in diet.”

THE CALORIE-RICH MICRONUTRIENT-POOR DIET

Carbohydrate (potato, rice and sweet potato) and fat calories are dense and inexpensive, but poor in micronutrients. The result is an “obesity epidemic associated with micronutrient malnutrition.”

Optimal nutrition will benefit many degenerative diseases.

Micronutrients reduce DNA damage and mitochondrial damage. **[IMPORTANT]**

“A multivitamin/mineral pill is inexpensive, recognized as safe, and supplies the range of vitamins and minerals that a person, requires although not the essential omega-3 fatty acids.” **[IMPORTANT]**

“Inadequate intakes of omega-3 fatty acids are widespread. Fish oil supplements with these essential fatty acids are available and inexpensive.”

Menstruating women need more iron than men or older women, who may be getting too much. “That is why two types of vitamin pills are marketed: one with iron and one without.”

DNA DAMAGE FROM VITAMIN AND MINERAL DEFICIENCIES

DNA damage is a cause of cancer.

"Deficiency of vitamins B-12, folic acid, B-6, niacin, C or E, or iron or zinc appears to mimic radiation in damaging DNA by causing single- and double-strand breaks, oxidative lesions or both."

"Half of the population may be deficient in at least one of these micronutrients."

"The quarter of the population that eats the fewest fruits and vegetables (five to nine portions a day is advised) has about double the cancer rate for most types of cancer when compared to the quarter with the highest intake: 80% of American children and adolescents and 68% of adults do not eat five portions a day."

"A number of other degenerative diseases of aging, such as heart disease, are also associated with low fruit and vegetable intake."

"*Folate* deficiency breaks chromosomes due to massive incorporation of uracil in human DNA (millions per cell)."

"Deficiencies of vitamins B-12 or B-6 also cause high levels of uracil incorporation in human DNA and chromosome breaks."

"*Iron* deficiency (25% of women of menstruating age in the US ingest <50% of the RDA) causes oxidative damage to mitochondria and mitochondrial DNA."

Zinc intake inadequacy causes oxidative DNA damage, inactivation of copper, zinc-superoxide dismutase [an enzyme antioxidant], inactivation of tumor suppression, and inactivation of oxidative DNA repair. This will cause severe genetic damage.

"Common micronutrient deficiencies are likely to damage DNA by the same mechanism as radiation and many chemicals and appear to be orders of magnitude more important."

SPERM DNA DAMAGE AND VITAMINS/MINERALS

"Inadequate micronutrient intake causes genetic damage to sperm."

Folic acid deficiency decreases sperm count in by 90%.

[How about that as part of infertility management?]

Uracil is found in sperm DNA of men on low fruit and vegetable diets.
Folate inadequacy in humans reduces both sperm count and sperm quality.

Men with low-vitamin C intake have more oxidative damage to their sperm DNA, and that male smokers (smoking depletes the vitamin C level markedly) had more oxidative damage to their sperm.

“Epidemiological data support the notion that smoking males have more offspring with childhood cancer” **[VERY IMPORTANT]**

“Zinc deficiency may also contribute to sperm damage; zinc is known to be essential for normal male reproductive function.”

Zinc is present at very high concentrations in seminal fluid.

There is a positive correlation between level of zinc in seminal plasma and total sperm count. **[Again, how about that as part of infertility management?]**

In a recent study 24 subfertile men who took a daily supplement that contained both 66 mg of zinc sulfate and 5 mg of folic acid for 26 weeks experienced a 74% increase in total normal sperm count.

Vegetarian males are generally more healthy than nonvegetarians. However, if they consume whole grains (which contain phytate), they can be at risk for low zinc intakes and reproductive problems.

MICRONUTRIENT INADEQUACY AND COGNITIVE DYSFUNCTION

Studies show that deficiencies in zinc, iron, folate/B12/B6, or the essential omega-3 fatty acids EPA and DHA impair cognitive function. **[IMPORTANT]**

Iodine deficiency causes neuromotor and cognitive development impairments in children, and adult diminished intellectual capacity and cognitive skills.

DHA and EPA.

“The long-chain polyunsaturated fatty acids (LCPUFA), docosahexaenoic acid (DHA), and eicosapentaenoic acid (EPA) are essential for proper brain development.”

“These fatty acids are found in fish oil, or can be made, somewhat inefficiently, from linolenic acid, an omega-3 fatty acid, present in certain nuts and vegetable oils.” **[Important For Strict Vegetarians]**

“Essential long-chain fatty acids such as DHA make up 30% of the fatty acids of the neurons and appear to be the factors in breast milk that account for the increased intelligence of children fed breast milk compared to formula.”

The American diet is quite low in these essential fatty acids. **[IMPORTANT]**

DHA deficiencies decrease neuron size.

DHAs involvement in the developing nervous system is extensively recognized.

"After birth, infants gain much of their DHA from breast feeding, as their rate of synthesis of DHA from alpha-linolenic acid is inadequate for their needs."

[This is very important for infants on formula. The formula must contain long chain omega 3s EPA (20 carbons) and DHA (22 carbons) and not solely flax seed alpha-linolenic acid (18 carbons)]

Deficiency in childhood can be damaging to neural development. **[IMPORTANT]**

"In adulthood, LCPUFA deficiency is involved in cognitive impairment without dementia and neurodegenerative impairment associated with Alzheimer's disease and Parkinson's disease and appears to be common in cognitive deficiency associated with aging." **[IMPORTANT]**

"Studies implicate DHA deficiency in Alzheimer's disease, attention-deficit hyperactivity disorder, and dementia." **[IMPORTANT]**

Zinc.

Zinc deficiency induces oxidative stress within the cell and damages DNA.

Zinc deficiency in infants and children arrests cognitive.

Zinc deficiency to cause reduced cognitive function.

"*Iron* deficiency causes a lowered level of heme in the mitochondria, which results in dysfunctional mitochondria and neurodegeneration."

Inadequate iron intake causes cognitive dysfunction.

"Iron deficiency causes neurological impairment in children, possibly through the effect on mitochondria."

"A large number of studies have found beneficial effects of micronutrient supplementation on cognitive function in children."

"*Folate, vitamin B12, or vitamin B6* deficiencies cause homocysteine accumulation, a risk factor for vascular diseases."

Vascular dementia and Alzheimer's disease are related to elevated Homocysteine.

Low intake of the vitamins folate, B-12, and B-6 with homocysteine accumulation contributes to Alzheimer's disease.

VITAMIN D

The hormone vitamin D is formed in the skin with the aid of ultraviolet (UV) light from sunlight.

"Northern populations in the US are exposed to insufficient sunlight and individuals are often chronically vitamin-D deficient unless" they take a supplement.

"Although both dark- and light-skinned individuals can produce vitamin D in response to UV light, this response is much more limited in dark-skinned individuals."

"In a study in Boston, 80% of African-Americans and 60% of Hispanics were vitamin D deficient."

Vitamin D is necessary for bone formation, reduces colorectal cancer and prostate cancer.

OBESITY: DO MICRONUTRIENT DEFICIENCIES COUNTERACT SATIETY?

"We hypothesize that micronutrient deficiency counteracts the normal feeling of satiety after sufficient calories are eaten." This results in an epidemic of obesity with associated insulin resistance and type II diabetes.

"Part of the reason for the obesity epidemic may be that energy-dense, micronutrient-poor diets leave the consumer deficient in key micronutrients and constantly hungry."

DELAYING THE MITOCHONDRIAL DECAY OF AGEING

"Oxidative mitochondrial decay is a major contributor to aging."

[Again, this means that free radicals are bad, and antioxidants are good].

Some reversal of mitochondrial decay occurs by supplementing with high levels of the mitochondrial metabolites acetyl carnitine (ALC) and lipoic acid (LA).

With age, increased oxidative damage[free radical damage] to protein "causes a deformation of structure of key enzymes with a consequent lessening of affinity (K_m) for the enzyme substrate."

Feeding the substrate ALC with LA, a mitochondrial antioxidant, restores the velocity of the reaction (K_m) and mitochondrial function.

Supplementation with ALC with LA for a few weeks restores mitochondrial function; lowers oxidants [free radicals], neuron RNA oxidation, and mutagenic aldehydes and increases ambulatory activity and.

"A recent meta-analysis of 21 double blind clinical trials of acetyl carnitine in the treatment of mild cognitive impairment and mild Alzheimer's disease showed significant efficacy vs. placebo" [89. S.A. Montgomery, L.J. Thal and R. Amrein. *Int. Clin. Psychopharmacol.* 18 (2003), pp. 61–71].

A meta-analysis of four clinical trails of lipoic acid for treatment of neuropathic deficits showed significant benefit.

Common micronutrient deficiencies accelerate mitochondrial decay. **[IMPORTANT]**

"Heme biosynthesis is predominantly in the mitochondria."

This biosynthesis is interfered with by:

- 1) Iron deficiency (25% of menstruating women in the US ingest <50% of the RDA).
- 2) Biotin deficiency, which is quite common in the population.
- 3) Copper deficiency.
- 4) Zinc deficiency, which causes marked oxidative stress.

"The consequences of these various deficiencies are likely to be accelerated aging and neural decay." **[Very IMPORTANT]**

MULTIVITAMINS IN HUMANS

"Evidence is accumulating that a multivitamin/mineral supplement is good insurance, and would markedly improve health, e.g., heart disease, cancer, immune function, and cataracts, particularly for the poor, the young, the obese, and the elderly."

Taking multivitamins / minerals, requires some caution: you can over consume iron, zinc, copper, selenium, and some of the vitamins, e.g., vitamin A.

"Advice to take a multivitamin should always be coupled with advice to eat a good diet, as we also need fiber and omega-3 fatty acids."

THE Km CONCEPT AND METABOLISM

"As many as one-third of all mutations in a gene result in the corresponding enzyme having an increased Michaelis constant/ K_m (a decreased binding affinity) for a coenzyme, and therefore result in a lower rate of reaction."

"Thus, many of the carriers of 50 human genetic diseases that are due to defective enzymes can be remedied or ameliorated by the administration of high doses of the B-vitamin component of the corresponding coenzyme, which raise levels of the coenzyme and at least partially restore enzymatic activity."

The following are known to improve with high doses of B vitamins as related to the *K_m* concept:

Cardiovascular disease
 Migraines
 Rages
 Hemolytic anemia
 Alcohol intolerance
 Alzheimer's disease
 Cancer

"The *K_m* concept is likely to be relevant for mitochondrial aging as well as for human nutrition."

PUBLIC HEALTH

A metabolic tune-up is likely to have great health benefits, particularly for those with inadequate diets such as many of the poor, young, obese, and elderly, who need improvement the most, although it is currently not being addressed adequately by the medical community.

"The issues discussed here highlight the need to educate the public about the crucial importance of optimal nutrition and the potential health benefits of a simple and affordable daily multivitamin/multi-mineral supplement."

"It is becoming clear that unbalanced diets will be the major contributor to ill health in the population with smoking following close behind."

KEY POINTS FROM DAN MURPHY

- 1) An optimum intake of micronutrients and metabolites would tune up metabolism and give a marked increase in health, particularly for the poor, young, obese, and elderly, at little cost.
- 2) Deficiency of vitamins B-12, folic acid, B-6, C or E, or iron or zinc appears to mimic radiation in damaging DNA.
- 3) Approximately 50 different human genetic diseases that are due to a poor binding affinity of enzymes and can be remedied by feeding high-dose B vitamins. (The *K_m* concept).
- 4) Mitochondrial decay is a major contributor to aging can be ameliorated with supplementation of high doses of acetyl carnitine and lipoic acid.
- 5) Many common micronutrient deficiencies cause increased mitochondrial decay with increased free radical production, leading to accelerated aging and neural decay.

- 6) Reduced micronutrient intake result in an increase in DNA damage (and cancer), or neuron decay (and cognitive dysfunction) or mitochondrial decay (and accelerated aging and degenerative diseases).
- 7) The requirements of the elderly for vitamins and metabolites are greater than those of the young.
- 8) Carbohydrate (potato, rice and sweet potato) and fat calories are dense and inexpensive, but poor in micronutrients. This result in our obesity epidemic, associated with micronutrient malnutrition.
- 9) Optimal nutrition will benefit many degenerative diseases.
- 10) Micronutrients reduce DNA damage and mitochondrial damage.
- 11) A multivitamin/mineral pill is inexpensive, recognized as safe, and supplies the range of vitamins and minerals that a person requires, although not the essential omega-3 fatty acids.
- 12) Inadequate intakes of -3 fatty acids are widespread.
- 13) Deficiency of vitamins B-12, folic acid, B-6, niacin, C or E, or iron or zinc mimics radiation in damaging DNA.
- 14) 80% of American children and adolescents and 68% of adults do not eat the minimum of five portions of fruits and vegetables per day.
- 15) Inadequate micronutrient intake causes genetic damage to sperm and is an important factor in infertility.
- 16) Smoking males have more offspring with childhood cancer.
- 17) Deficiencies in zinc, iron, folate/B12/B6, or the essential omega-3 fatty acids EPA and DHA impair of cognitive function.
- 18) The long-chain polyunsaturated fatty acids, docosahexaenoic acid (DHA), and eicosapentaenoic acid (EPA) are essential for proper brain development and for the increased intelligence of children.
- 19) The brain's requirement for DHA cannot be met by being vegetarian.
- 20) Deficiency in DHA damages a child's to neural development, causes cognitive impairment and neurodegenerative, is associated with Alzheimer's and Parkinson's, with attention-deficit hyperactivity disorder, with dementia, and with age related cognitive deficiency.

- 21) *Folate, vitamin B12, or vitamin B6* deficiencies cause homocysteine accumulation, a risk factor for vascular disease, and contribute to Alzheimer's disease.
- 22) 80% of African-Americans and 60% of Hispanics are vitamin D deficient.
- 23) The regular consumption of energy dense micronutrient deficient diets reduces the normal feeling of satiety after sufficient calories are eaten, contributing to the obesity epidemic and insulin resistant diabetes.
- 24) Free radical damage to the mitochondria is a major contributor to aging, and can be partially reversed with high doses of acetyl carnitine and lipoic acid.
- 25) A multivitamin/mineral supplement would markedly improve health, reducing heart disease, cancer, immune function, and cataracts, particularly for the poor, the young, the obese, and the elderly.
- 26) Advice to take a multivitamin should always be coupled with advice to eat a good diet, as we also need fiber and omega-3 fatty acids.
- 27) Unbalanced diets are the major contributor to ill health in the population with smoking following close behind.