

Nutrition

Review article on **measuring acid base balance**

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Epsom Salts bath

"After initial pilot studies, all volunteers took baths (temperatures 50-55°C) and stayed in the bath for 12 minutes."

"....soaking in Epsom salts therefore increases blood magnesium concentrations..."

".....all individuals had significant rises in plasma magnesium and sulfate at a level of 1% Epsom salts. This equates to 1g MgSO₄/100ml water; 600g Epsom salts/60 litres, the standard size UK bath taken in this project (~15 US gallons). However, most volunteers had significantly raised Mg/SO levels on baths with 400g MgSO added. Above the 600g/bath level, volunteers complained that the water felt 'soapy'."

"The values obtained suggest that most people would find maximal benefit by bathing 2 or 3 times/week, using 500-600g Epsom salts each time."

"Bathing in Epsom salts is a safe and easy way to increase sulfate and magnesium levels in the body."

R.H Waring

Report on Absorption of magnesium sulfate (Epsom salts) across the skin
School of Biosciences, University of Birmingham, United Kingdom

Facts & Stats

- 5000IU Vitamin D3 = 125 micrograms
- folic acid supplementation linked to breast cancer. May be best to use folate
- protein + omega 3 reduces body inflammation

spermidine

- located in ribosomes
- in food sources that include ribosomes
- longevity nutrient
- polyamine, extends the lifespan of mice, cardioprotective in both aged mice and hypertensive rats.
- In humans....high dietary spermidine intake reduced blood pressure, lower incidence of heart disease

Nucleotides

- nucleotide supplementation improves the composition of the gut microbiota
- proteins = bunch of polypeptides
- polypeptides = bunch of peptides
- peptides = bunch of amino acids
- amino acids = bunch of nucleotides
- nucleic acids = DNA, RNA = bunch of nucleotides
- nucleotides = nucleosides with phosphate attached
 - adenosine-5 monophosphate [AMP]
 - guanosine-5 monophosphate [GMP]
 - cytidine-5 monophosphate [CMP]
 - uridine-5 monophosphate [UMP]
- nucleosides = nucleobases + something
 - adenosine, guanosine, cytidine, uridine, thymidine
- nucleobases = adenine, guanine, cytosine, uracil, thymine

- some of ingested RNA and dietary nucleotides reach the blood stream and are transported to tissues of the body.
- some of dietary RNA and dietary nucleotides are incorporated into nucleic acids.
 - especially small intestine, liver, muscle
 - amount increases during times of stress, trauma, rapid growth, low food supply
- RNA & DNA are digested in the small intestine, to nucleotides via action of the pancreatic enzyme ribonuclease, deoxy-ribonuclease producing:
 - adenosine-5 monophosphate [AMP]
 - guanosine-5 monophosphate [GMP]
 - cytidine-5 monophosphate [CMP]
 - uridine-5 monophosphate [UMP]
 - thymidine-5 monophosphate [TMP]

- These nucleotides are then hydrolyzed to the nucleosides
 - adenosine
 - guanosine
 - cytidine

uridine
thymidine

- These nucleosides may be further hydrolyzed to;
purine bases = adenine, guanine.....then to uric acid
pyrimidine bases = cytosine, uracil, thymine.....then to beta alanine
- the nucleosides are transported in the enterocytes by both facilitated diffusion and sodium-dependent carrier mediated process
- nucleosides and bases that are not catabolized in the enterocytes are transported via the portal circulation to the liver, where they are also catabolized

Fatty Acids

- essential fatty acids improve endothelial cell function, increase nitric oxide

Long Chain Fatty Acid Binding Proteins [LCFA]

- transport long chain fatty acids across the cell membrane
- fatty acid translocase
- fatty acid transport protein
- fatty acid binding protein
- once across the cell membrane, long chain fatty acids are bound to cytosol LCFA binding proteins

Conjugated linoleic acids

- 28 isomers of linoleic acid
- beef, cow dairy
- inhibit chemically induced cancer in mice
- a trans fatty acid and a cis fatty acid
- produced by microorganisms in the rumens of ruminants.
- non-ruminants, including humans, produce certain isomers of CLA from trans isomers of oleic acid, such as vaccenic acid, which is converted to CLA by delta-9-desaturase.
- in healthy humans, CLA and the related conjugated linolenic acid isomers are bioconverted from linoleic acid and alpha-linolenic acid, respectively, mainly by Bifidobacterium bacteria strains inhabiting the gastrointestinal tract

Essential Sugars

- 8 essential sugars
 - simple sugars
 - glucose [short chain]
 - galactose [short chain]
 - fucose [short chain]
 - xylose [short chain]
 - mannose [medium chain]....in aloe
 - longchain sugars
 - N-acetylgalactosamine [long chain]
 - N-acetylglucosamine [long chain]
 - N-acetylneuraminic acid [long chain]
- pectin [long chain polysaccharide].....in apples
- plant sugar.....long chain polysaccharide
 - beet sugar
 - cane sugar

Intestines

- micro-organisms in lumen affects micro-organisms in lumen affects development of intestinal immune system
- micro-organisms in lumen produce important nutrients
- intestinal mucus overlies the epithelium, limiting contact between bacteria and epithelial cells
- Goblet cells.....regulate production of mucus and factors that contribute to epithelial repair and regulation of inflammation
- Paneth cells.....produce anti-microbial peptides [ie. alpha-defensins]
- epithelial cells are a barrier to bacteria getting into blood stream
- epithelial cells have tight junctions between them. "Leaky gut" is opening in the spaces between the cells [inflammatory bowel]
- People with crohn's, inflammatory bowel have depletion and reduced diversity of mucosa associated phyla Firmicutes and Bacteroidetes
- Non-celiac gluten sensitivity
 - prevalence of first generation anti-gliadin antibodies of IgG
 - non-celiac gluten sensitivity patients 93.2% show disappearance of anti-gliadin antibodies of IgG class after 6 months of gluten-free diet....40% of celiac patients display persistence correlated with the low compliance to gluten free diet

Resveratrol

- long term low dose resveratrol in drinking water.....resulted in an increase in CD4+CD25+ cells [in old mice]
- marker of DNA oxidative damage = 8OHdG.....increases with age
 - 8OHdG is reduced by resveratrol
- Resveratrol reduces hypoxia and ischemia induced brain injury
- Resveratrol protects against the neurotoxicity effects in ALS
- low dose is best, around 300mg
- Longevinex is produced from Giant Knotweed

Selenium

- brain....organoselenium compounds.....ebselen and diphenyl diselenide
- display neuroprotective activities mediated at least in part by their antioxidant and anti-inflammatory properties
- Ebselen prevents glutamate-induced lipid peroxidation and cell death
- diphenyl diselenide modifies glutamatergic synapse parameters
- selenium compounds, as well as the antioxidant trolox, avoid the increase on glutamate-induced stimulation of ecto-nucleotidase activities
- Thyroid function depends on selenium.....at the active center of the iodothyronine deiodinase enzymes that catalyze the conversion of the prohormone thyroxine [T4] to the active form of thyroid hormone, triiodothyronine [T3]

Sodium

- sport drink should have about at least 100mg sodium per 8 ounces
- table salt = 40% sodium
- one teaspoon salt = 5g salt
- sodium loss in urine = 25mg per day
- sodium loss in skin = 100mg per day
- sodium loss in feces = 25mg per day
- sodium concentration in sweat [in trained people]
 - Low = 690mg per liter
 - average = 1150mg per liter

Potassium

- in fruit it is bound to citrate
- citrate is a buffer, prevents bone demineralization
- potassium concentration in sweat = 390mg per liter

Iron

- cofactor for cytochromes
- cofactor for enzymes
- free iron.....catalyzes formation of ROS
- bound iron = bound to proteins.....ferritin, transferrin
- intra-cellular iron, 5% is free in cytoplasm

Iron Regulatory Elements [IRE]

- coded in untranslated portion of Mrna
- interact with 2 cellular proteins = Iron Regulatory Proteins
 - IRP-1
 - IRP-2
- IRE's have different functions depending on where its located [start end or finish end of mRNA]
- can facilitate or interrupt protein synthesis

Beta glucans

- a form of complex polysaccharides
- ubiquitously found in both bacterial or fungal cell walls
- implicated in the initiation of anti-microbial immune response
- act on several immune receptors [Dectin-1, complement receptor, TLR-2/6]
- trigger a group of immune cells including macrophages, neutrophils, monocytes, natural killer cells and dendritic cells
- most β -glucans enter small intestine, captured by the macrophages, transported to marrow
- fragments are eventually released by macrophages, taken up by other immune cells, causes responses
- β -glucans of different sizes have different immune potency

Vitamin D

- testis and/or liver function affects Vitamin D status
- 25-hydroxylase activity is affected by product from liver/testis

- CYP2R1....a microsomal enzyme produced by leydig cells in testis....may activate 25-hydroxylase
- takes 1000IU to raise your Vit D levels by 5ng/ml
- should be at least 30ng/ml
- age 70 production of Vit D about 4 times less than age 20

Vitamin C

- cumulative total 3000mg spread out across a day acts as an anti-histamine in allergy

Magnesium

- best forms for absorption, word ends with the letters "ate"
- Magnesium sulphate increases brain glucose levels via increases in glut-3 glucose transporters
- GLUT-3 is the predominant neuronal glucose transporter and contributes to the transport of glucose
- most appropriate ratio of calcium to magnesium is 1:1.
- magnesium oxide supplements....4% absorbed
 - 96% to intestines...
 - tends to have a laxative effect, helpful if you are challenged with constipation.

L-Carnitine

is a peripheral antagonist of thyroid hormone action. It inhibits the entry of triiodo thyronine and thyroxine into the cell nuclei. Through a randomized trial, Benvenga et al. showed that 2–4 g of oral L-carnitine per day could reverse hyperthyroid symptoms even in the most serious form of hyperthyroidism: thyroid storm. They suggest that since hyperthyroidism impoverishes the tissue deposits of carnitine, there is a rationale for using L-carnitine at least in certain clinical settings. Incidentally, the fact that carnitine failed to prevent relapses of hyperthyroidism further supports the concept that carnitine action is in the periphery and not in the thyroid gland

N-acetyl-L-cysteine

- reduces effects of beta amyloid accumulation
- inhibits beta amyloid accumulation

Arginine

- supplementation of 8g per day for 3 weeks
 - increased endothelial cell function
 - increased vasodilation
 - increased SOD-1

Phosphatidylcholine

- increases the solubility of cholesterol and thereby decreases cholesterol's ability to induce atherosclerosis
- Phosphatidylcholine aids in lowering cholesterol levels, removing cholesterol from tissue deposits, and inhibiting platelet aggregation
- The high content of linoleic acid in phosphatidylcholine may be responsible for much of the benefit derived from supplementation

Vitamin K2

- helps build calcium deposits in bone
- in circulatory system, activates a protein.....Matrix Gla Protein [MGP], potent arterial calcification inhibitor
- is fat soluble
- treating something = 180mcg per day
- not treating something = 100mcg per day

B vitamins

- supplement....methyl folate is the form of folic acid to get
- Nicotinamide adenine dinucleotide.....NAD+
- coenzyme form of the vitamin niacin
- protect against autoimmune diseases by regulating how CD4+ T cells differentiate
- NAD+ can block and reverse the progression of experimental autoimmune encephalomyelitis (EAE), a preclinical model for human multiple sclerosis, by promoting myelination and neural tissue regeneration.
- NAD+ protects against EAE by altering T-cell differentiation through a novel noncanonical enzymatic pathway independent from previously described classical cytokine and transcription factor signaling.

major carotenoids

- lycopene

- lutein
- zeaxanthin
- beta-carotene.....can be used to make other carotenoids

Aged Garlic [kyolic]

- aged garlic extract = AGE
- contains S-allylcysteine, S-allylmercaptocysteine
- increases SOD, catalase, glutathione peroxidase, and glutathione
- decreases cholesterol synthesis
- decreases homocysteine
- lowers blood pressure

Curcumin

- anti-inflammatory, antioxidant effect, neuro- and cardioprotective

Phosphatidylserine

- increases brain hippocampus neurogenesis at dose 50mg per kg body weight per day

Cranberry juice

- two commercially available cranberry juice cocktails...The juice cultures completely prevented any biofilm formation

caffeine

- caffeine [~250mg] increases cortisol levels for ~ 12 hours
- acts as an A1 and A2 adenosine receptor antagonist
- caffeine may also work like catecholamines, causing an increase in IL-6, which counteracts IL-1, thus decreasing immune function
- caffeine causes cerebrovascular vasoconstriction (possible mechanism of increased oxidative stress to neurons)...(ischemia/hypoxia induced brain cell destruction)
- caffeine is the most widely consumed psychotropic drug. Reaches max bloodstream levels within 30-45 minutes after ingestion. Alters hypothalamus/pituitary. Blocks calcium absorption, affects osteoarthritis and osteoporosis. Caffeine promotes arrhythmias.
- caffeine intake may lead to adaptations of serotonergic neurons that decreases conversion of tryptophan to serotonin, which will result in depression.
- caffeine is completely absorbed.....100% bioavailable.....absorbed within 45 minutes
- metabolized in the liver by cytochrome P-450 enzyme system.....[Cytochrome P-450 1A2...(CYP1A2)]
- 80% of caffeine = biotransformation/degradation to paraxanthine....and small amounts of theobromine, theophylline
- further metabolized to xanthines, uric acids, and uracils
- caffeine has a half-life of 4 – 6 hours

Alcohol

- alcohol can decrease thyroid function
 - T3, T4, TSH all decrease with alcohol consumption
 - Alcohol is a depressant.
 - Alcohol ingestion may elicit transitory stimulant effect (disinhibition of reticular activating system). Moderate alcohol consumption increases estradiol levels 300% in post menopausal women, which is above the level achieved with estrogen replacement therapy. Elevation persists for 4 - 5 hours. The effect is cumulative compared to non-drinkers.
 - caused enhanced GABA transmission, the mechanism of depressant function and CNS impairment
 - inhibits NMDA evoked release of dopamine/norepinephrine
 - is an NMDA receptor (glutamate receptor) antagonist
 - decreases glutamate binding in hippocampus and cortex
 - decreases length and density of dendrites in hippocampus
 - voltage gated ion channels are the primary targets (suppresses calcium influx through voltage gated channels)
 - suppresses TNF-alpha secretion by ~50%
 - cause increased susceptibility to pulmonary infections
 - chronic intake depletes liver mitochondrial glutathione levels by inducing defective transport of glutathione from cytosol into mito..
- 7 grams of ethanol in
- 270ml beer
 - 100ml wine
 - 30ml liquor
 - intoxicating dose ~ .8g/kg = 48g for 60kg person
 - the product of alcohol metabolism = acetaldehyde (a pro-oxidant) --- leads to glutathione inactivation
 - acetaldehyde causes oxidative catabolism of folate.....is an inhibitor of methionine synthase
 - thus can increase homocysteine and heart disease, causes zinc deficiency
 - Alcohol dehydrogenase (ADH) is a zinc containing enzyme located in the cytoplasm of cells
 - alcohol is broken down into acetaldehyde (AA) by ADH, using NAD as a cofactor
 - highest concentrations of ADH are in the liver...80-90%

part of alcohol ingested will be eliminated by enzymes in the gastrointestinal tract

AA levels in the colon are much higher than in the liver

AA inhibits DNA repair enzymes, alters cellular membranes resulting in cell injury, causes production of antibodies that result in inflammatory reactions, destroys folate leading to homocysteine accumulation, causes glutathione depletion by inhibiting methionine synthase

- chronic alcohol reduces translational efficiency
 - alcohol decreased eIF2B activity
 - increases binding of 4E-BP1
 - decreases phosphorylated 4E-BP1
- alcohol dehydrogenase metabolizes alcohol in the liver
- brain alcohol levels may be similar to blood alcohol levels

Inflammatory bowel

- chron's disease = upper bowel
- colitis = lower bowel

Conversion equations

beta-carotene

From IU to mcg: $IU * 0.6 = mcg$

For example: $5000 IU * 0.6 = 3000 mcg$

From mcg to IU: $mcg / 0.6 = IU$

Vitamin D

From IU to mcg: $IU * 0.025 = mcg$

For example: $400 IU * 0.025 = 10 mcg$

From mcg to IU: $mcg / 0.025 = IU$

Vitamin E [DL-Alpha-tocopherol]

From IU to mg: $IU * 0.9 = mg$

For example: $30 IU * 0.9 = 27 mg$

From mg to IU: $mg / 0.9 = IU$

Vitamin E [D-Alpha-tocopherol]

From IU to mg: $IU * 0.67 = mg$

For example: $30 IU * 0.67 = 20.1 mg$

From mg to IU: $mg / 0.67 = IU$