

MYOPIA AND NUTRITION



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Myopia epidemic

- Crisis
 - There is a higher percentage of people with myopia than ever reported in history.
 - A recent National Eye Institute Study pointed out that in the USA
 - 1970's 25% myopia
 - 2000 41% myopia

Myopia is extremely prevalent

- It affects more than 25 to 35% of European descent populations and up to 50% or more of Asian descent populations.

Causes of Myopia?

- One Nutrient “The Silver Bullet?”
- Diet....blood sugar regulation & nutrient levels
- Sustained accommodation (strength & tone)
- Increased vitreous IOP (F. Young)
- Scleral Stretching...(strength and tone)
- Heredity “Genes”

MYOPIA AND VISION

- There seems to be five areas of ocular concern that effect the eyes and the development of myopia which can be nutrient oriented.
 - Blood sugar regulation
 - IOP
 - Clarity of the cornea, crystalline lens
 - Circulation and nerve function
 - Strength and tone of the retina, sclera and choroid

MYOPIA AND VISION

- We will discuss nutrients and studies for these tissues and conditions of the eyes.

The "Silver Bullet"

- One nutrient or Magic/Silver Bullet?
- It is amazing that patients and doctors both believe in the Silver Bullet.....
It Does Not Exist.

Biochemical aspects

- Biochemical aspects may be a crucial link between accommodation/retinal defocus and myopic axial elongation.
- Accommodatively-related defocus/image degradation appears to trigger specific biochemical changes in the sclera and related structures that results in posterior pole axial elongation

Biochemical aspects

- Glycosaminoglycans are involved in collagen fibrillogenesis.
- GAG's influence collagen size and its organization and are highly represented in eye tissue.
- Speculation is that modification of collagen in the sclera of myopes occurs due to retinal defocus/image degradation effects

Biochemical aspects

- GAG metabolism might reflect this process.
- Uronic acids in the urine, which are related to and correlated with GAG metabolism, have been measured in human myopes and nonmyopes.
- Uronic acid was 2-3 times greater in myopes.

Biochemical aspects

- Reduced levels of hydroxyproline (related to collagen accumulation) were found in both human blood serum levels and human sclera.
- The results suggested that myopic axial elongation was the result not only of simple biochemical scleral stretching but also to changes in its biochemical constitution.

Biochemical aspects

- These biochemical aspects were taken from "Accommodation, Nearwork and Myopia" Ong E, Ciuffreda K; OEPF 1997 page 194

Further Biochemical Aspects

- In my work with nutrition I have found a correlation between myopia and low antioxidant levels, moderately increased IOP, and diets high in sugars, artificial colorings, flavorings, and preservatives and low in vegetables and fruits.
- Further, hair analysis high in heavy metals consistent in increasing myopia.
- Lead, cadmium, mercury and arsenic

Further biochemical aspects

- For some reason I have been finding more patients/myopes high in bismuth. I don't know the ramifications of this observation.



*Can't eat pork,
Swine flu...*



*Can't eat chicken,
Bird flu.*



*Can't eat Beef,
Mad cow....*



*Can't eat eggs,
Salmonella.*



*Can't eat fish,
heavy metal poisons in their
waters.*



*Can't eat fruits and veggies,
insecticides and herbicides.*



*I believe that leaves
chocolate and ice cream!*

Diet

- Only 20% of children in the US consume five or more servings of fruits and vegetables daily. Study included 3148 participants, ages 2 to 18.
- All were low in citrus, melon, berries, and dark green or deep yellow vegetables.
- Only 7% met the recommended guidelines of two fruits and three veggies daily.

Diet continued

- French Fries accounted for nearly 25% of vegetable consumption.
- This study confirmed that children's eating patterns mirror those of adults.
 - Antioxidants, Nutraceuticals and Functional Foods by Robert A. Ronzio, PhD; Townsend Letter for Doctors and Patients; Dec. 1996

Diets

- High in refined starches, (i.e), breads and cereals increase insulin levels.
- This effects the development of the eyeball, making it abnormally long and causing near sightedness.
- Suggested by a team led by Loren Cordain, an evolutionary biologist at Colorado State University.

An Interesting Thought:

- Would myopic individuals survive in a hunter gatherer society?
- Good distance acuity is required for
 - location of food
 - recognition of other species members
 - awareness of environmental dangers and benefits
 - recognition and escape from predators

Cordain's Study

- 229 hunter-gatherer societies
 - Although refined cereals and sugars were rarely if ever consumed
 - with Western contact these foods quickly became dietary staples!!

Genes

- Myopic genes would be eliminated from a hunter gatherer society?
- Probably as they wouldn't survive very long.

Hunter gather societies

- Myopia prevalence normally occurs in 0-2% of the population.
- Most refractive errors are less than minor.
- Moderate to high myopia is either non-existent or occurs in about one person out of a thousand.

Hunter Gatherer Diets

- Characterized by high levels of protein
- Moderate levels of fat
- Low levels of carbohydrate
- When compared to modern Western diets.

Carbohydrates

- Carbohydrates present in hunter-gatherer diets are of **LOW GLYCEMIC INDEX**.
- That means: they are slowly absorbed and produce a gradual and minimal rise in plasma glucose and insulin levels when compared to the sugars and refined starches in Western diets.

Recently Acculturated Hunter-gatherer Populations

- When they adopt a Western diet
 - frequently show high levels of
 - hyperglycemia
 - insulin resistance
 - hyperinsulinemia
 - type II diabetes

Conversely

- Hunter-gatherer populations in their native environments rarely exhibit these symptoms!

The Industrial Revolution

- Industrialized countries shifted slowly from hunter-gatherer societies.
- With the advent of the industrial revolution
 - more refined sugars
 - more refined cereals

Cordain

- When these hunter-gatherer societies change their lifestyles and introduce grains and carbohydrates, they **RAPIDLY DEVELOP (WITHIN ONE GENERATION)** myopia rates that equal or exceed those in western societies.

Modern Urban Diet

- Common elements of the diet are:
 - Highly refined sugars and cereals
- These were rarely eaten by the average citizen in the 17th and 18th century Europe.
- Steel roller mills in the late 19th Century introduced fiber depleted wheat flour of low extraction.

Over the last 200-250 years

- Glycemic load has steadily risen
- Increased consumption of refined cereals and sugars.
- This increase in sugars is related to increased levels of insulin.

Overnight Epidemics

- Fewer than 1% of Inuit and Pacific Islanders had myopia.
- These rates have skyrocketed to as high as 50%
- Was this the sudden advent of literacy and compulsory schooling?

Cordain

- Reading may play a role in myopia development, however...
- Myopia has remained low in societies that have adopted Western Lifestyles but not Western diets.

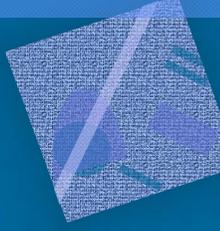
Cordain

- In the island of Vanuatu
- 8 hrs of compulsory schooling per day.
- Myopia rate is only 2%
- Vanuatians eat
 - fish
 - yam
 - coconut
 - no white bread or cereals

THEORY

- Consistent with the observations that people are more likely to develop myopia if they are:
 - are overweight
 - have adult-onset diabetes
 - Both of which involve elevated insulin levels

Dr. Joseph Mercola



The progression of Myopia has been shown to be slower in children whose protein consumption is increased

High Carbohydrate Intake Increases Insulin Levels

- Elevated insulin from consumption of excess grains and sugars will serve to increase free insulin-like growth factor (IGF-1).
- This can accelerate scleral tissue growth during critical developmental stages thus leading to myopia.

A Variety of Studies

- Suggest that high carbohydrate diets may cause permanent changes in the development and progression of refractive errors, particularly during periods of early growth and development.

Theory

- High insulin levels from carbohydrate loads could disturb the delicate choreography that normally coordinates eyeball lengthening and lens growth.
- If the eyeball grows too long, the lens can no longer flatten itself enough to focus a sharp image on the retina.

Populations Studies

- Demonstrate that people of Asian and Chinese descent tend to be more insulin resistant than people of European descent.
- The prevalence of myopia is also higher in Asian populations than in European populations.

Theory

- It is possible that the higher rates of myopia in Asian populations may, in part, be due to their increased genetic susceptibility to insulin resistance.
- Acta Ophthalmologica Scandinavica, March 2002, Vol 80, p 125

Nutrients that help control blood sugar



Nutrients for Blood Sugar Regulation

- Chromium
- Potassium
- Omega 3 fatty acids
- Amino acid complex
- Vit C
- Bilberry
- Glutathione
- Alpha Lipoic Acid

Nutrients for Blood Sugar

- Cinnamon
- Magnesium

Stevia

- has been used traditionally to treat diabetes.
- It is suggested that stevia might have beneficial effects on glucose tolerance.
- Even if stevia did not have direct antidiabetic effects, its use as a sweetener could reduce intake of sugars in such patients.

Chromium

- Essential for glucose utilization
- Glucose powers the ciliary muscle fibers for accommodation
- Often will balance blood sugar levels without any other supplement
- Liquid organic chromium (aqueous)
- Picolinate, rice protein chelate, ascorbate

Chromium

- 73% of type I and II diabetics who took chromium supplements reduced their requirement for insulin or oral hypoglycemic agents. Taking chromium and niacin together reduced fasting blood sugar levels and improved glucose tolerance. J. Trace Elem Exp Med. 1995;8:183-90; Urberg M, Zemel MB, Metabolism 1987;36:896-99

Blood Sugar Levels

- Blood sugar lowered = hyperopia
- Blood sugar rise = myopia
- Blood sugar levels effect water retention or dehydration, which effects Refractive Indes.

Potassium

- Deficiency of Potassium and Phosphorus are associated with insulin resistance.
- Deficiency of Chromium, Copper, manganese, and zinc are associated with glucose intolerance.
- Potassium must be supplemented carefully as hyperkalemia may be induced.

Potassium continued

- Nutritional Influences on Illness; Melvyn Werbach,MD; 2nd edition, Third Line Press, Tarzana, CA, pp 229-255

Alpha Lipoic Acid

- Alpha lipoic acid (also known as thioctic acid) is a vitamin-like natural antioxidant. Alpha lipoic acid is sometimes referred to as the "universal antioxidant," since it is soluble in both fat and water.¹

Alpha Lipoic Acid

- In experimental models
 - increases neuronal blood flow
 - improves neuronal glucose uptake
 - increases reduced glutathione in neurons
 - improves neuronal conduction velocity
 - In combination with Vit E may prevent oxidative stress in cardiac ischemia-reperfusion injury

Alpha Lipoic Acid

- Shows promise to prevent
- Metal poisoning
 - lead, arsenic, cadmium, mercury
 - chemical poisoning
 - hexachlorobenzene
 - n-hexane
- Natural Medicines Comprehensive Database; Fifth Edition, Stockton, CA; pp 48-49

Alpha Lipoic Acid

- It enhances glucose uptake in non-insulin-dependent diabetes (NIDDM), inhibits glycosylation (the abnormal attachment of sugar to protein), and has been used to improve diabetic nerve damage (at an intake of 600 mg per day) and reduce pain associated with that nerve damage.²

Alpha Lipoic Acid

- There is some evidence that alpha lipoic acid, taken in the amount of 150 mg daily for one month, improves visual function in people with both stage I and stage II glaucoma.³

Alpha Lipoic Acid

- There is only limited knowledge about the food sources of this nutrient, however foods that contain mitochondria (a specialized component of cells), such as red meats, are believed to provide the most alpha lipoic acid. Supplements are also available.

Alpha Lipoic Acid

- The amount of alpha lipoic acid used in research to improve diabetic neuropathies is 600 mg per day and 150 mg per day for glaucoma. However, much lower amounts, such as 20–50 mg per day, are recommended by some doctors of natural medicine for general antioxidant protection, although there remains no clear evidence that such general use has any benefit.

Alpha Lipoic Acid

- Individuals who may be deficient in vitamin B1 (such as alcoholics) should take vitamin B1 along with alpha lipoic acid supplements. Chronic administration of alpha lipoic acid in animals has interfered with the actions of the vitamin biotin; whether this has significance for humans remains unknown.⁵

Alpha Lipoic Acid

- 1. Packer L, Witt EH, Tritschler HJ. Alpha-lipoic acid as a biological antioxidant. *Free Rad Biol Med* 1995;19:227–50 (review).

Alpha Lipoic Acid

- 3. Filina AA, Davydova NG, Endrikhovskii SN, et al. Lipoic acid as a means of metabolic therapy of open-angle glaucoma. *Vestn Oftalmol* 1995;111:6–8.

Alpha Lipoic Acid

- 5. Zempleni J, Trusty TA, Mock DM. Lipoic acid reduces the activities of biotin-dependent carboxylases in rat liver. *J Nutr* 1997;127:1776–81.

Cinnamon

- Can improve glucose and cholesterol levels in the blood
- Alam Khan, PhD used 500mg capsules of cinnamon daily for 40 days with 60 men and women. Found a significant reduction in blood glucose in all those taking the cinnamon. Also improves triglyceride levels.

Cinnamon

- Other botanicals can improve glucose metabolism and overall condition by removing artery-damaging free radicals from the blood and improving function of small vessels: onions, garlic, ginseng, and flaxseed.
- In rabbit and rat studies fenugreek, curry, mustard seed, and coriander have cholesterol-improving effects

Cinnamon

- December "Diabetes Care (2003; Vol. 26:3215-8
- Information from JAOA, April 2004, Vol., 75/ Number 4, page 212, Article by Dr. Newman

Essential Fatty Acids

- Important in treatment of diabetic neuropathy and IOP
- Significantly improved microangiopathy in diabetics
- Werbach; Nut Inf. on. Ill., page 253; Houtsmuller AJ et al, Nut Metab 24 (supp-1): 105-18, 1980
- (more later)

EFA

- Essential fatty acids (Omega 3,6) are essential for normal development in mammals.
- Omega 3 fatty acids--> development and function of the retina and cerebral cortex and other organs.
- Omega 6--> growth, reproduction, and maintenance of skin integrity

EFA

- Docosahexanoic acid (DHA)
- Eicosapentaenoic

Glutathione

- One of the most potent and essential antioxidants in the body and especially the eye

Glutathione

- Glutathione and its related enzyme precursor amino acids (N-Acetyl-Cysteine, L-glycine, and glutamine and selenium) are protective against damage to human retinal pigment epithelium cells.
- Sternberg, Davidson, Jones, et al. "Invest. Ophth. Vis. Sci. 1993 Dec.;34(13):3661-8

Bilberry

- 79% of 37 patients with visible diabetic retinal abnormalities improved after taking 160mg of Bilberry extract BID, as compared to 0% of placebo group.
- 86% of abnormalities showed moderate to considerable improvement
- Nat Ophth pp 36-37; Perossini, et al. Ann Ottalmol Clin Ocul 1987

Bilberry

- Study confirms that bilberry could improve visual acuity and lead to faster light dark adjustment
- Bilberry anthocyanosides decrease vascular permeability. Interacts with collagen to increase cross-links
- Maintains normal blood barrier permeability and limits increase in vascular permeability

Bilberry

- "Topic: Bilberry fruit, "The Lawrence Review of Natural Products, Oct. 1995, pp 1-2

Bilberry

- Anthocyanosides, the bioflavonoid complex in bilberries, are potent antioxidants¹. They support normal formation of connective tissue and strengthen capillaries in the body. Anthocyanosides may also improve capillary and venous blood flow.

Bilberry

- Bilberry herbal extract in capsules or tablets standardized to provide 25% anthocyanosides can be taken in the amount of 240-480 mg per day or 1-2 ml two times per day in tincture form.
- 1. Salvayre R, Braquet P, et al. Comparison of the scavenger effect of bilberry anthocyanosides with various flavonoids. *Proceed Intl Bioflavonoids Symposium*, Munich, 1981, 437-42. (Healthnotes)

Magnesium

- Magnesium is the most evident abnormality of metal metabolism seen in diabetes mellitus.
 - Hypomagnesemia is associated with ischemic heart disease and retinopathy in diabetic patients.
 - Mg has an integral role in glucose metabolism by being a cofactor in glucose transport

Mg continued

- Mg is important in enzymatic reactions that are needed for metabolism of carbohydrates, lipids, and proteins.
- The release of insulin and the maintenance of pancreatic B-cell cycles are dependent on adequate Mg status.
- Insulin acts like a Mg sparing hormone.

Magnesium

- Open angle glaucoma patients and normal-tension glaucoma patients were given magnesium twice daily
- Showed improvement of visual field and reduced peripheral vasospasms after four weeks of treatment.
- Gasper, et al. Ophthalmologica 1995;209(1):11-3

Magnesium

- Diabetic patients with high serum magnesium levels were less likely to develop severe diabetic retinopathy compared to those with low levels.
- Diabetes 1978 Nov;27(11):1075-7

Magnesium

- Chromium, high dose vit. E, Mg, soluble fiber, and possibly taurine appear likely to lessen risk for macrovascular disease (retinopathy) in diabetics.
- McCarty, Med Hypothesis 1997, Aug; 49(2):143-52

Mg

- Low Mg levels might increase the risk of ischemic heart disease and severe retinopathy in diabetes, while chromium increases insulin sensitivity and raises the good HDL cholesterol.
- Tuvemo, T. Pediatrician 1983-85; 12(4):213-9

Creation and Health

In the beginning, God created the Heavens and the Earth and populated the Earth with broccoli, cauliflower and spinach, green and yellow and red vegetables of all kinds, so Man and Woman would live long and healthy lives.

Creation and Health

Then using God's great gifts, Satan created Ben and Jerry's Ice Cream and Krispy Creme Donuts. And Satan said, "You want chocolate with that?"

And Man said, "Yes!" and Woman said, "and as long as you're at it, add some sprinkles."

And they gained 10 pounds.

Creation and Health

And Satan smiled.

Creation and Health

And God created the healthful yogurt that Woman might keep the figure that Man found so fair. And Satan brought forth white flour from the wheat, and sugar from the cane and combined them. And Woman went from size 6 to size 14.

So God said, "Try my fresh green salad." And Satan presented Thousand-Island Dressing, buttery croutons and garlic toast on the side. And Man and Woman unfastened their belts following the repast.

Creation and Health

God then said, "I have sent you heart healthy vegetables and olive oil in which to cook them."

And Satan brought forth deep fried fish and chicken-fried steak so big it needed its own platter. And Man gained more weight and his cholesterol went through the roof.

God then created a light, fluffy white cake, named it "Angel Food Cake," and said, "It is good."

Creation and Health

Satan then created chocolate cake and named it "Devil's Food." God then brought forth running shoes so that His children might lose those extra pounds.

And Satan gave cable TV with a remote control so Man would not have to toil changing the channels. And Man and Woman laughed and cried before the flickering blue light and gained pounds.

Creation and Health

Then God brought forth the potato, naturally low in fat and brimming with nutrition.

And Satan peeled off the healthful skin and sliced the starchy center into chips and deep-fried them. And Man gained pounds.

God then gave lean beef so that Man might consume fewer calories and still satisfy his appetite.

Creation and Health

And Satan created McDonald's and its 99-cent double cheeseburger.

Then said, "You want fries with that?"

And Man replied, "Yes! And super size them!" And Satan said, "It is good."

And Man went into cardiac arrest.

God sighed and created quadruple bypass surgery.

Creation and Health

Then Satan created HMOs.

Nutrients for clarity of cornea and crystalline lens



The Crystalline Lens

- Experimental animals missing either Histidine or phenylalanine develop pre-cataract conditions, i.e.:
 - Widening of the sutures
 - Separation of fiber cells
 - Haziness of the lens
 - Diets missing Histidine will produce cataracts in three weeks (Heal. Nut. With.)

Nutrients for lens clarity

- Amino acid complex
- Vit B 1,2,3,6
- Vit C and E
- Glutathione
- Magnesium
- SOD and Catalase
- Selium

SOD and Catalase

- UV light creates photochemical reactions---> superoxide free radicals, (main component in photo-oxidative destruction)--->leads to cataract formation and ARMD.
- SOD (an enzyme)---> breaks down superoxide free radicals---> hydrogen peroxide,---> scavenged by catalase

SOD

- Zinc and Copper are cofactors for SOD production.
- One of the results of lipid peroxidation is accumulation of pigment lipofuscin susceptibility.

Vitamin E

- Essential in all areas of the body
- Most studies use alpha tocopherol but some used both alpha and gamma
- Beaver Dam study
 - highest alpha and gamma tocopherol concentrations had 60% lower risk for developing nuclear cataracts. Nat Oph pp30 2003

Vitamin E

- A case control study in Canada (5yrs)
- Robertson, J, Donner, A., Trevithick, J.; A Possible Role for Vitamins C and E in cataract prevention. American Journal of Clinical Nutrition. Vol. 53(suppl)pp346s052s, 1991
- Those people who did not have cataracts reported taking more E & C

Vitamin E

- Those people that supplemented with E & C had half the risk of cataract
- Another 5 yr. Study; Leske, M., Chylack, L., He, Q. Antioxidant Vitamins and Nuclear Opacities
 - multivitamin users had 1/3 the risk of nuclear opacities
 - Vitamin E users had 1/2 the risk

Vitamin E

- Seth, R., Kharb, S. Protective Function of Alpha Tocopherol Against the Process of Cataractogenesis in Humans
 - 50 cataract patients 1/2 cortical, 1/2 nuclear
 - 100mg E BID
 - 40% reduction in cortical lens opacity
 - 14% decrease in nuclear lens opacity

Vitamin E

- 25% increase of Vit E in cortical tissue and 21% increase in nuclear lens tissue
- 52% increase of glutathione in cortical lens tissue and 16% increase in nuclear lens tissue.
- Sparing of glutathione is observed in many other studies (section on diabetes in same article)

Selenium

- Selenium activates an antioxidant enzyme called glutathione peroxidase
- Selenium is also needed to activate thyroid hormones.
- adult dose of 100-200 mcg of selenium per day

DMG

- Prevents posterior subcapsular cataract in experimental animals.
- Frequently appears to reverse early PSC in clinical practice in doses of 125mg twice daily
- Werbach 201(Todd GP;Nutrition, Health & Disease, 1985

Cysteine or Methionine

- Glutathione protects the lens from UV
- Concentration diminishes with age
- Cysteine or methionine are rate-limiting amino acids in glutathione synthesis
- Werbach 201; Cole H.; Enzyme activity may hold the key to cataract activity. JAMA 254(8):1008, 1985

Taurine

- Taurine deficiency has been shown to lead to retinal degeneration and supplementing it has been used with some success to prevent, treat and stabilize retinal change.
- *Altern Med Rev* 1998 Apr; 3(2):128-36.
Oftalmol Zh 1989;(8):463-5 *Brain Res Brain Res Rev* May-Aug;16(2):151-69 *J Neurosc Res* 1987;18(4):602-14

Taurine

- Plays a role in rhodopsin regeneration
- Essential to retinal pigment epithelium and the photoreceptors
- In these cells it is found at levels 10 times higher than other free amino acids
- Protects cell membranes from oxidative attack

Taurine

- assists in elimination of potentially toxic substances
- In combination with retinol protects lipids twice as with retinol alone
- Protects rod outer segment lipids during exposure to cyclic light.
- *Nat Opth;Comp of Clin Stud vit min*; 2003, CH 6 pp51

Taurine

- Diabetes increases retina requirements for taurine
- Glucose rapidly decreases taurine in retinal pigment cells
- Taurine uptake is increased in retina and RPE with higher levels of insulin and glucose concentration

Taurine

- May protect the lens against development of "Sugar cataracts" by antioxidant effect.
- Deficiency has been shown to lead to retinal degeneration
- Nat Ophth; Comp Clinc Stud vit min, Chap 6 pp37, pp44, pp50

Amino Acids in the Lens

- Leucine, Isoleucine, Phenylalanine, Tryptophane, Valine, Methionine, Tyrosine, Proline, Glutamic acid, Threonine, Aspartic acid, Serine, Glycine, Arginine, Lysine, Histidine, Cysteine.

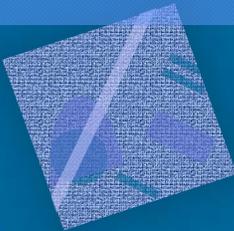
Crystalline lens

- Glutathione and Vit. C play a vital role in regulation of protein synthesis of the lens.
- Improved protein synthesis enhances:
 - lens construction, clarity, flexibility
- Lack of any of the listed amino acids can cause diminished lens clarity.

Nutrition and Vision

- Role of Lutein in Cataract Formation
- Examined the consumption of vegetables on incidence of cataracts in 50,000 over an 8 year period
- Significant reduction by 50% with ingestion of spinach (5 servings per week)
- No reduction with carrots, sweet potato, winter squash or broccoli

Nutrients to control IOP



Nutrients for IOP

- Vit. C, Chromium, Vit. A, (Thyroid), Alpha Lipoic acid, Bilberry, Ginkgo Biloba, Coffee, Coleus Forskohlii, Selenium, Transfatty acids (very bad), Folic acid, Essential fatty acids, Biotin, Triphalla, Licorice

Stress

- Above average stress has been shown to increase the risk for high eye pressure by almost three times
- Grignolo, F.M. et al. Variations of intraocular pressure induced by psychological stress. *Klinische Monatsblaten Augenheilkd* 170 (1977): 562-69

"B" vitamins

- B1,2,3,6 are important in amino acid metabolism
- Riboflavin (B2) = increased lens clarity
- B6 phosphate (P5P) is the most potent form of pyridoxine

Vitamin C

- A powerful antioxidant
- water soluble with many functions in the body
- Major function is in making collagen
 - strengthens muscle and blood vessels
 - antioxidant, antiviral, antihistimine
 - smoking depletes; approximately 75mg per cigarette

Vitamin C

- Protects other antioxidants, A, E, EFA's
- Functions as a coenzyme in some situations
- Used to treat glaucoma and cataracts
- Protects against adverse effects of UV light in the cornea, lens, vitreous and retina

Vitamin C

- High blood levels are strongly associated with decrease in subcapsular cataract
- Has been used to treat ARMD in conjunction with beta carotene, zinc, selenium, vitamin E
- The crystalline lens has more vit C than other organ except the adrenal glands

Vitamin C

- Lowering IOP results from ability to improve collagen formation, increase blood osmolarity, improve aqueous outflow, inhibit lipid peroxidation and raise glutathione levels
- Virno M, Bucci M et al; Oral treatment of glaucoma with vitamin C, *Eye, Ear, Nose, Throat Monthly*; 46;1502-8, 1968

Vitamin C

- Aleksidze A, Beradze I, Golovachev: Effect of ascorbic acid of the aqueous humor on the lipid peroxidation process in the eye in primary open angle glaucoma; Ophthalmol Ah OG8(2):114-6, 1989

Vitamin C

- Subjects taking vitamin C supplements for more than 10 yrs. Had a 45-77% lower risk of early lens opacities and 83% lower risk of moderate lens opacities. The higher the serum levels, the lower the risk of cataracts.
- Jacques, et al; The American Journal of Clinical Nutrition, Oct 1997. Hankinson, et al. 1992 BMJ:305:335-339. Simon et al, J. Clin. Epidemiol, 1999, Dec;52(12):1207-11

Vitamin C

- In studies done since 1935, vitamin C has been shown to prevent and even reverse the negative effects of sugar on the eyes.
- Blondin, J, Baragi, VK, Schwartz, E, Sadowski, J. and Taylor, A. "Prevention of lens protein damage by dietary vitamin c. Federal Proceedins 45 (1986):478

Vitamin C

- All types of sugars, not just white sugar, can impair the lens's ability to keep itself clear.
- Gaby, A.R., and Wright, J.V. "Nutritional Factors in Degenerative Eye Disorders: Cataract and Macular Degeneration." Wright/Gaby Nutritional Institute, 1991

Chromium

- Chromium is an essential trace mineral that helps the body maintain normal blood sugar levels.
- It may also play a role in maintaining healthy levels of HDL

Chromium

- Chromium, Vit E, Mg, fiber, and taurine appear likely to lessen risk for macrovascular disease (retinopathy) in diabetics. McCarty, Med Hypotheses 1997 Aug;49(2):143-52

Chromium

- IOP is strongly associated with low levels of chromium.
- Important in glucose metabolism
- Adequate levels allow near focus for extended periods of time.

Ginkgo Biloba

- GBE contains Ginkgo flavone glycosides and terpene lactones
- GBE regulates tone and elasticity of blood vessels (both arteries and capillaries)
- Antioxidant effects in Brain, Retina, and Cardiovascular system
- Increase circulation to brain and extremities

Ginkgo Biloba

- Ginkgo flavone glycosides
 - Bioflavonoids
 - antioxidant properties
 - inhibit platlet aggregation
 - support brain and CNS
 - prevent circulatory diseases

Ginkgo Biloba

- Terpene lactone components
 - Ginkgolides
 - improve circulation
 - inhibit platlet activating factor
 - Bilobalides
 - protect nerve cells of nervous system
 - may regenerate damaged nerve cells

Coleus Forskohlii

- There is some preliminary evidence that forskolin suspension eye drops (1%) can significantly decrease IOP in healthy people without eye disease.
 - Natural Medicines Comprehensive Database. 5th edition 2003

Coenzyme Q10

- A powerful antioxidant---protects from free radicals
- Works in the mitochondria to produce ATP
- Is virtually in every cell in the body
- Helps in congestive heart failure
- Essential in the eyes for function and energy

Licorice Root

- Glycyrrhetic acid (active ingredient in licorice root) inhibits enzymes that catalyze the conversion of prostaglandin E2 and prostaglandin F2 alpha (PGF2 alpha) into inactive metabolites.
- The effect is to increase the availability of naturally occurring prostaglandin F2 alpha. Latanoprost is a synthetic PGF2 alpha analog.

Licorice root

- John Veach, OD; Glaucoma Case Report: a nutritional response; JAOA Volume 74/number 12, December 2003; Oprometry 2003;74:775-81

Genistein

- A soy protein isoflavone
 - antioxidant
 - protein kinase inhibitor
 - plays a role in maintaining trabecular meshwork and opti nerve extracellular matrix
 - protein kinase inhibitors are being investigated as possible agents for IOP reduction
 - Ibid

45% IOP reduction

- Reliv (a patented supplement)
- Glaucoma case report: a nutritional response
- John E. Veach, OD
- JAOA, Dec. 2003, Vol 74/nNumber12, pp775-780

Omega-3 fatty acid

- Eskimos who have a high intake of omega-3 have a very low incidence of open angle glaucoma. Albrick, P.H., Angle closure surveys in Greenland Eskimos, Canadian Journal of Ophthalmology 8(1973): 260-64

Omega 6 fatty acid

- Linoleic acid is converted to----> GLA by delta-6-desaturase enzyme----->converts to DGLA----> converts to PGE1
- In diabetics delta-6-desaturase may be blocked
- Treatment for diabetic neuropathy and IOP

Evening Primrose Oil

- Convert to a hormone-like substance called prostaglandin E1 (PGE1)
- Conversion to PGE1 is adversely effected by:
 - disease, aging process
 - saturated fats and hydrogenated oils
 - blood sugar problems
 - inadequate; vit C, Mg, Zn, B vits

Evening Primrose Oil

- Effects IOP control and trabecular meshwork
- Supplements that provide GLA circumvent these conversion problems
 - more predictable formation of PGE1

Rutin

- 15% reduction of IOP and increased response to miotics. (after 4+ weeks)
- 20mg TID (Werbach p 300, Nut inf on illness)

Thyroid

- Thyroid malfunction (hypothyroid) has been associated with increased IOP.
- Treating the thyroid condition has normalized IOP, obviating need for glaucoma therapy.
- Hypothyroid can effect retinal health and lens clarity

Food Sensitivities

- Avoidance of foods that cause allergic reactions may reduce IOP due to reduced inflammation

Plant Enzymes

- My experience

Transfatty acids

- Increased IOP is strongly associated with excess protein and transfatty acids such as margarine or deep fried foods.
- Transfatty acids circumvent conversion of PGE1 from GLA

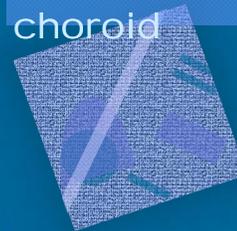
Vitamin A

- Vitamin A: 25,000 iu for two to three months can lower IOP
- In the Nutrition and Eye Disease Study, moderate levels of Vit. A intake were associated overall with a 40% decrease risk of nuclear sclerotic opacity. Among smokers, risk of cataract was reduced by 50%. Mares-Perelman, J.A., Klein B.E.K., et al. "Relationship Between Lens Opacities and Vitamin and Mineral Use." Ophth 1944;101:315-325

Vit. A

- Nurses Health Study, a large cohort of nurses had been followed for almost 20 yrs. In this longitudinal study, increased dietary intake of Vit. A was associated with a 39% reduction in risk of cataract extraction. Hankinson, SE, Stampfer, MJ. et al. BMJ Vol. 305, 1992

Nutrients for strength and tone...retina, sclera, choroid



Nutrients for strength and tone

- Vit. A B complex Magnesium
- Folic acid Vit E Bilberry
- Calcium Phos Eyebright
- Potassium Sodium Taurine
- L-Arginine Dunaliella salina
- Ginkgo Biloba Cayenne
- Vinca Minor Lutein (carotenoid)

L-Arginine

- Assists in wound healing
- ensures that cells divide properly
- helps remove ammonium from the body
- facilitates immune function
- promotes the secretion of several hormones including glucagon, insulin, and growth hormone.

L-Arginine

- Arginine is a precursor to nitric oxide, which the body uses to keep blood vessels dilated, allowing the heart to receive adequate oxygen.
- Individuals with herpes (either cold sores or genital herpes) should not take arginine, because it can stimulate replication of the virus.

L-Arginine

- Some are concerned that increases in growth hormone triggered by arginine could overwork the pancreas.
- Low doses don't seem to cause problems.

L-Arginine

- 3 month treatment with L-arginine in diabetic patients has been reported to effectively reduce levels of plasma lipid peroxides.
- Lowers cholesterol, the higher the arginine to lysine ratio the lower the cholesterol.
- Found in meat, nuts, eggs, milk, and cheese

Arginine continued

- Has been shown to improve learning and memory

Nitric Oxide

- NG-nitro-L-arginine methyl ester (L-NAME) a nitric oxide synthase inhibitor--inhibited choroidal thickness in conjunction with myopic defocus
- Thus nitric oxide may play a role in modulating choroidal thickness.
- Nickia DL, Wilken E, Lutle G, et al Exp Eye Res 2006 Aug;83(2):456-64

7-methylxanthine

- A metabolite of caffeine, increased collagen density and the diameter of collagen fibrils in the posterior sclera which may prevent myopia
- Trier K, Olsen EB, Kobayashi T, Ribell-Madsen SM, Br J Ophthalmol, 199 Ccc 83(12):1370-5
- Legerton, Chow Review of Opt Aug 2009

Myopia and Nutrition

- Changes in scleral glycosaminoglycan synthesis accompany lens-induced changes in the length of the eye.
- Changes in the thickness of the choroid are also associated with changes in the synthesis of glycosaminoglycans.
- Legerton, Chow, Review of Opt, Aug 2009

Folic acid

- Folic acid is needed for DNA synthesis.
- Folic acid is also needed to keep homocysteine (an amino acid) levels in blood from rising. Excess homocysteine dramatically increases the risk of heart disease and may be linked to osteoporosis and strokes.

Folic Acid

- if people are deficient in vitamin B12 and take 1,000 mcg of folic acid per day or more, then the folic acid can improve anemia caused by the B12 deficiency.

Folic Acid

- May be inversely correlated with the prevalence of cataracts. (Jacques PH et al. Vitamin intake and senile cataract. Abstract. J Am Nutr. 6(5):435,1987;Werbach; Nut Inf III 1996

Nutrients for Circulation and Nerve Function



Nutrients for Circulation and Nerve Function

- Vits. B 1,3,5,6 Inositol, Choline, Vit. D, Bioflavonoids, B12, Calcium, Chromium, Copper, Iron, Magnesium, Potassium, Sodium, Zinc, Manganese, Phosphorous, Sulphur, Bilberry, Ginkgo Biloba, Garlic, Cayenne, Vinca Minor, Ginger, Eyebright.

Vitamin B12

- Coenzyme forms:
- Dibenzozide
- Methylcobalamin
- Glaucoma patients treated with vit B12 for over 5 years demonstrated better visual acuity and better overall control of their disease. *Glaucoma*, 1992; *Oftalmol ZH* 1965; 20960. *Klin Oczna* 1974 Nov. 44(11):1183-7

B12 continued

- Japanese researchers found that a significant number of glaucoma patients that took 1500 mcg B12 for five years actually gained some sight while others showed no deterioration, even though eye pressures did not reduce. Sakai, T. Murata, M, and Amemiya, T, Effect of long term treatment of glaucoma with B12. *Glaucoma* 14 (1992): 167-70

Alpha Lipoic Acid

- Open angle glaucoma patients
 - 150mg daily
 - 40-47% enhanced color visual fields and visual sensitivity
 - more advanced cases had even better response compared to controls
 - Felina, et al., *Vestn Oftalmol* 1995 Oct-Dec; 111(4):6-8

Alpha Lipoic Acid

- Pretreatment with alpha lipoic acid has been found to reduce neuronal damage from excitotoxic damage from cyanide, glutamate and iron ions, demonstrating a strong neuroprotective effect for neural tissue.
- *J. Cereb, Blood Flow Metab* 1995 Jul;15(4):624-30

Alpha Lipoic Acid

- Lipoic acid may be useful in the treatment of glaucoma and may prevent ischemic optic nerve damage. *Altern Med Rev* 1998 Aug;3(4):308-11

Alpha Lipoic Acid

- Can significantly reduce diabetic cataract formation, as well as neuropathy, and would seem to be an ideal neuroprotective substance in the treatment of all oxidative brain and neural disorders involving free radical processes.
- *Packer, L., Ann Ny; Acad Sci* 1994 Nov 17;738:257-64. *Packer, L Free Radic Biol Med* 1997;22(1-2):359-78

Fats

- Diets high in fat may be associated with an increased risk of developing wet macular degeneration.
- Study indicated high intake of vegetable, monosaturated and polyunsaturated were associated with a two-fold risk of wet macular degeneration

Fats

- These bad fats are found in potato chips, french fries, cakes, commercially prepared pies.
- High intake of linoleic acid, (also in snack foods) was associated with the greatest risk of wet mac degen.
- Those people who consumed little foods containing lenoleic acid and ate two or more

Fats

- Servings of fish per week showed a lower risk of AMD.
- Fish are high in DHA which is beneficial in cardiovascular disease, a healthful effect on blood vessels leading to the retina, and may have a positive effect on retinal function.

Fats

- Dr. Johanna Seddon, Massachusetts Eye and Ear Infirmary. Harvard Medical School et al, August 2001; Archives of Ophthalmology, 800 patients

Fats

- Two forms of fish oils exist today. The natural triglyceride form and the ethyl ester form.
- The best is the TG form and can be told apart by a simple test.
- Place 20ml of fish oil in a polystyrene cup. Observe in 10 minutes. If ester form it will leak through the cup.

Copper

- It is also part of the antioxidant enzyme superoxide dismutase (SOD), essential in the crystalline lens to maintain clarity.
- Copper is needed to make adenosine triphosphate (ATP), the energy the body runs on.
- collagen requires copper(the "glue" that holds muscle tissue together

Magnesium

- Patients suffering from open angle and normal-tension glaucoma who were given Mg twice daily showed improvement of the visual field and reduced peripheral vasospasm (which can cause glaucoma, stroke, and heart attack) after 4 weeks of treatment. Gasper, et al Ophthalmologica 1995; 209(1): 11-3

Zinc

- Zinc is a component of more than 300 enzymes that are needed to repair wounds, maintain fertility, synthesize protein, help cells reproduce, preserve vision, boost immunity, and protect against free radicals, among other functions.

Zinc

- can reduce retinol dehydrogenase, an enzyme needed to help vitamin A work in the eye
- oral zinc sulfate was associated with retardation of visual loss in AMD. Newsome et al; Oral Zinc in Macular Degeneration; Arch Ophth, Vol 106 Feb 1988

Ginger

- Ginger is a classic tonic for the digestive tract.
- stimulates digestion
- keeps the intestinal muscles toned.
- eases the transport of substances through the digestive tract, lessening irritation to the intestinal walls.³

Ginger

- may protect the stomach from the damaging effect of alcohol and nonsteroidal anti-inflammatory drugs (such as ibuprofen) and may help prevent ulcers.⁴
- supports a healthy cardiovascular system
- makes blood platelets less sticky and less likely to aggregate

Cayenne

- Contains capsaicinoids, carotenoids, flavonoids and steroid saponins
- Used for circulatory conditions
- Reduces platelet stickiness
- Acts as an antioxidant
- Used for diabetic neuropathy
- Used for arteriosclerosis

Garlic

- More than 250 publications have shown that garlic supports the cardiovascular system. It may lower cholesterol and triglyceride levels in the blood, inhibit platelet stickiness (aggregation), and increase fibrinolysis—which results in a slowing of blood coagulation. It is mildly antihypertensive and has antioxidant activity.^{1,2}

Garlic

- 1. Kleijnen J, Knipschild P, Ter Riet G. Garlic, onion and cardiovascular risk factors: A review of the evidence from human experiments with emphasis on commercially available preparations. *Br J Clin Pharmacol* 1989; 28:535-44.
- 1. Kleijnen J, Knipschild P, Ter Riet G. Garlic, onion and cardiovascular risk factors: A review of the evidence from human experiments with emphasis on commercially available preparations. *Br J Clin Pharmacol* 1989; 28:535-44.

Vinca Minor

- Increases cerebral oxygen consumption
- Increases cerebral circulation
- Improves retinal blood flow
- Useful for cerebral arteriosclerosis with poor memory
- Stroke victims with cerebral vascular deficiency

Vinca Minor

- Combine with mistletoe or Ginkgo to strengthen capillary walls.
- Is an antihemorrhagic
- No known health hazards
- Some gastrointestinal complaints and skin flushing have been observed
- Overdose can cause drop in BP

Bioflavonoids

- Diabetes
- Cataracts
- Inflammation
- Edema
- Capillary fragility
- (Nutritional Influences on Illness, Werbach)

Carotenoids

- Several studies have shown that lutein and zeaxanthin supplements may slow vision loss in glaucoma, and in some cases improve eyesight. *Science News*, Volume 146
- Collard greens and spinach two to four times per week lowered risk of macular degeneration by 46% and even greater for 5 to 6 times per week

Carotenoids

- Goldberg, J, et al, Factor associated with age-related macular degeneration: An analysis of data from the First National Health and Nutrition Examination Survey. *American Journal of Epidemiology* 128 (1988):700-20

Carotenoids

- Study examined 421 patients with AMD and 615 control patients.
- Higher risk associated with cigarettes and serum cholesterol levels.
- No lower risk with zinc levels, sunlight exposure, or iris color.
- Significantly lower risk ($p=0.0001$) associated with serum carotenoid levels.
 - *Eye Disease Control Study. 1992. Arch.Ophth. 110:1701-1708*

Carotenoids

- Biochemical Role for Lutein in ARMD
- Photo-oxidation leads to lipid peroxidation, highly toxic to retina
- Lutein and zeaxanthin inhibit damage due to blue light.
 - Snodderly, D. Max, 1995. *Am J. Clin. Nutr.* 62S:1448S-1461S.

Interactions

- Flavonoids and anthocyanidins interact with Vitamin C to stabilize collagen synthesis (strengthens ocular tissues and effects trabecular meshwork.
- May work to reduce IOP and prevent or reduce scleral distention.

For your information

- Calcium deficiency may lead to scleral distention (Lane).
- Glutathione should be supplemented (selenium and E), (Glycine + cysteine + glutamic acid = glutathione (GSH) or Glutathione peroxidase
- Vit. E is important in GSH metabolism

Continued

- Vit. B6 is needed to properly metabolize amino acids
- Mg and Zn are essential to GSH metabolism
- Fats:
 - a. What are good fats
 - b. What are bad fats
 - c. How do fats effect the eyes

Chondroitin Sulfate

- Chondroitin sulfate consists of repeating chains of molecules called mucopolysaccharides. Chondroitin sulfate is classified as a type of glycosaminoglycan; it is rich in sulfur and is related to glucosamine. Chondroitin sulfate is a major constituent of cartilage, providing structure, holding water and nutrients, and allowing other molecules to move through cartilage
- (Healthnotes)

MSM

- Sulfur is needed for:
- manufacture of many proteins, including the proteins that form hair, muscles, and skin.
- Sulfur contributes to fat digestion and absorption, since it is needed to make bile acids.

Sulfur (MSM)

- Sulfur is also a constituent of bones, teeth, and collagen (the protein in connective tissue).
- As a component of insulin, sulfur is needed to regulate blood sugar.
- Claims have been made regarding methylsulfonylmethane (MSM) in the treatment of a wide variety of disorders.

MSM

- Very little research can be found on MSM.
- Patients with glaucoma have significantly reduced IOP, headaches, allergies, and dry eye symptoms.
- Research is much needed in this area.

Glucosamine Sulfate

- Glucosamine sulfate provides the joints with the building blocks they need to repair damage caused by osteoarthritis or injuries. Specifically, glucosamine sulfate provides the raw material needed by the body to manufacture a mucopolysaccharide (called **glycosaminoglycan**) found in cartilage. Glucosamine sulfate may also play a role in wound healing

How do we find and test for Deficiencies

- Diet diary
- Symptoms
- Blood analysis
- Hair analysis
- Urine analysis

How to treat, supplement and dose

- Diet
- Vitamin supplements
- Mineral supplements
- Amino acid supplements
- Herbs
- Multiple vitamin, mineral, amino acid, herbal formulas

What does all of this have to do with myopia

- Development
- Progression
- Reduction
- Reversal

Exercise

- Glaucoma patients taking a brisk 40 minute walk 5 days a week for 3 months reduced IOP by approximately 2.5 mmHg. Passo, M.S. et. Al. Regular exercise lowers IOP in glaucoma patients. Investigative Ophthalmology 35, In ARVO Abstracts, March 15, 1994

Exercise

- Essential to good health
- Acutely lowers glucose and triglyceride levels in a dose dependent fashion.
- Helps maintain normal weight
- Improves cardiovascular system

Characteristics of The Metabolic Syndrome

1. Abdominal obesity
2. Atherogenic dyslipidemia
3. Elevated Blood Pressure
4. High insulin levels-over10
 - a. Raises fats into cells
 - b. Promotes fat storage
 - c. Stimulates arterial smooth muscle cells
 - d. Promotes production of bad types of eicosanoid (EC)- intracellular hormones
 - e. Series one ECs are good and may be inhibited by too much flaxseed
 - f. Series two ECs are bad--glucagon is a strong inhibitor of EC2 pathway
5. Promotes retention of fluids by kidneys
6. High levels of inflammatory mediators as measured by C-Reactive Protein levels

Glucagon is the anti-insulin and is increased by high proteins low carbohydrates

Larry Alexander, Canadian Journal of Optometry, Vol 71, No 3, May 2009

Nutrition Questionnaire

- 1. What is your **daily consumption of the following:**
 - How many servings of dark leafy greens?
 - How many servings of fruits?
 - How many servings of fish per week?
 - What beverages and how much?
 - A. Coffee
 - B. Alcohol
 - C. Water
 - D. Soda drinks
 - E. Juices

Nutrition Questionnaire

- 2. How much sleep do you get per night?
 - A. Sound sleep
 - B. Interrupted sleep
- 3. How many minutes of exercise do you get per day?
 - A. What type of exercise?
 1. Running, walking
 2. Weight lifting/Sports
 3. How many flights of stairs daily

Nutrition Questionnaire

- 4. What supplements do you take and how frequently?
- 5. Do you have a family history of eye disease?
 - A. Glaucoma
 - B. Macular degeneration
 - C. Dry eye syndrome
 - D. Cataracts