NUTRITION, BEHAVIOR AND THE ARCHETYPE
COPE 38817-GL

LARRY J ALEXANDER OD FAAO

http://www.eyelenss.com/articles/item/nutrition-and-behavior-as-it-applies-to-glaucoma

GLAUCOMA CALZONE

http://www.pillsbury.com/recipes/beacon-burger-calzones/66129food-8edo-4528:
6b35-f057775983

Critical review: vegetables and fruit in the prevention of chronic diseases. Boeling H, Bechthold A, Bob A, et al. A critical review on the associations between the intake of vegetables and fruit and the risk of several chronic diseases shows that a high daily intake of these foods promotes health. Therefore, from a scientific point of view, national campaigns to increase vegetable and fruit consumption are justified. The promotion of vegetable and fruit consumption by nutrition and health policies is a preferable strategy to decrease the burden of several chronic diseases in Western societies. (Eur J Nutr. 2012 Sep. 51(6):687-83)


The association between glaucoma prevalence and supplementation with the antioxidants calcium and iron. Wang SY, Singh K, Lin SC. Results suggest that there may be a threshold intake of iron and calcium above which there is an increased risk of development of glaucoma. Prospective longitudinal studies are needed to assess whether antioxidant intake is a risk factor for development and progression of glaucoma. (Invest Ophthalmol Vis Sci. 2012 Feb 3;53(2):725-31)

2013-25 CASE OF THE WEEK
What Is It? STARS IN HER EYES?

Nico Esterhuizen, B. Optom.
Mark Lawrence Optometry South Africa
EYELESSONS.com 2013

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27 YO CAUCASIAN FEMALE

• CC: ROUTINE EXAM
• BEST CORRECTED ACUITY 20/20 O.U.
• IOP 19 mmHg
• MED HX FAMILY GLAUCOMA, THYROID EYE DISEASE, MACULAR DEGENERATION
• MEDS: SWITCHING ZYTOMIL, SERDEP, CYMGEN, GLUCOPHAGE FOR WEIGHT LOSS, TRIPELINE, FEMEDENE
FUNDUS O.U. BILATERAL AND SYMMETRICAL MACULAR CRYSTALLINE DEPOSITS

FUNDUS O.U. BILATERAL AND SYMMETRICAL MACULAR CRYSTALLINE DEPOSITS

NEGATIVE EFFECTS OF GREAT NUTRITION

ANGLES ARE OPEN

NO EVIDENCE OF GCC THINNING

CRYSSTALINE MACULOPATHY

CRYSSTALS DIFFICULT TO LOCALIZE BUT NOTE MILD TEMPORAL THINNING. IMAGING ELIMINATES EXUDATES AS NO EDEMA
CRYSTALLINE DIFFICULT TO LOCALIZE BUT NOTE MILD TEMPORAL THINNING...IMAGING ELIMINATES EXUDATES AS NO EDEMA

IMPRESSION

• APPARENT INTRARETINAL CRYSTALLINE DEPOSITS IN MACULAR AREA
• NO EVIDENCE OF RNFL COMPROMISE
• NO EVIDENCE OF GCC COMPROMISE
• SLIGHT THINNING PERIFOVEAL BUT NO EVIDENCE OF EDEMA THAT WOULD CONTRIBUTE TO EXUDATE FORMATION

• RELATIONSHIPS TO CRYSTALLINE MACULOPATHY

DIFFERENTIAL DX OF CRYSTALLINE DEPOSITS IN MACULA OF YOUNG PATIENT

• WEST AFRICAN CRYSTALLINE MACULOPATHY
• GENETIC DISORDERS
  – BIETTI’S CRYSTALLINE DYSTROPHY
  – GYRATE ATROPHY
  – CYSTINOSIS
  – SJOGREN-LARRSON SYNDROME
  – PRIMARY HEREDITARY HYPEROXALURIA

DIFFERENTIAL DX OF CRYSTALLINE DEPOSITS IN MACULA OF YOUNG PATIENT

• TOXIC EXPOSURE
  – CANTHAXANTHINE..ORAL TANNING AGENT
  – TAMOXIFEN
  – NITROFURANTOIN (MACRODANTIN..)
  – SECONDARY HYPEROXALURIA
    • METHOXYFLURANE
    • ETHYLENE GLYCOL
• VASCULAR
  – TALC RETINOPATHY
  – IDIOPATHIC JUXTAFOVEAL TELANGIECTASIA

DIFFERENTIAL DX OF CRYSTALLINE DEPOSITS IN MACULA OF YOUNG PATIENT

• METABOLIC DISORDERS
  – SECONDARY HYPEROXALURIA
  • EXCESSIVE INGESTION OF OXALATES
  • HYPERABSORPTION OF OXALATES
    – SARCOID
    – CIRRHOSIS
    – SMALL BOWEL RESECTION
    – RENAL FAILURE


• SOURCES
  – RHUBARB
  – SPINACH
  – BEET GREENS
  – OKRA
  – PARSLEY
  – LEEKS
  – COLLARD GREEN
• THERE ARE A FEW, RELATIVELY RARE HEALTH CONDITIONS THAT REQUIRE STRICT OXALATE RESTRICTION. THESE CONDITIONS INCLUDE ABSORPTIVE HYPERCALCIURIA TYPE II, ENTERIC HYPEROXALURIA, AND PRIMARY HYPEROXALURIA.
FOR AN EXCELLENT REVIEW SEE


Caveat: When using any guidelines one must consider correlation with other patient characteristics and other clinical tests such as but not limited to: chief complaint, age, gender, ethnicity, refractive status and best corrected acuity, family history, associated medical conditions, current medications, pachymetry, visual field testing, angle assessment.

DEFINITION OF GLAUCOMA

- Vascular Component...Glaucoma is Slow Ischemic Optic Neuropathy
- Neuro-Degenerative Component...Glaucoma is Like Dementia
- Inflammatory Component...Glaucoma is Affected by the Immune System
- Physical Component...Glaucoma can be a Physical Restriction in Aqueous

Evidence for the use of nutritional supplements and herbal medicines in common eye diseases. West AL, Oren GA, Moroi SE. The available evidence does support the use of certain vitamins and minerals in patients with certain forms of age-related macular degeneration. For cataracts, the available evidence does not support these supplements to prevent or treat cataracts in healthy individuals. For diabetic retinopathy and glaucoma, the available evidence does not support the use of these supplements. In the category of herbal medicines, the available evidence does not support the use of herbal medicines for any of these ocular diseases. (Am J Ophthalmol. 2006 Jan;141(1):157-66.)

Use of herbal medicines and nutritional supplements in ocular disorders: an evidence-based review. Wilkinson IT, Fraunfelder FW. Current data does not support the use of antioxidants or herbal medications in the prevention or treatment of cataracts, glaucoma or diabetic retinopathy. It is important for providers to be aware of the benefits and the significant potential adverse effects that have been associated with nutritional supplements and herbal medications, and to properly inform their patients when making decisions about supplementation. (Drugs. 2011 Dec 24;71(18):2421-34)
Positive Actions Supported in the Literature

• Minimizing inflammation
• Normalizing ocular collagen and protecting ocular tissue against the neurotoxicity of glutamate.
• Address nutrients that exert specific influences on Glycosaminoglycans (GAGs)
• Increasing ocular antioxidant defenses and scavenging harmful free radical molecules.
• Increasing the ocular level of glutathione to improve outflow and minimize antioxidant activity
• Preventing inappropriate release and actions of nitric oxide (NO) and vasoconstrictors from vascular endothelium.

Positive Actions Supported in the Literature

• Improving ocular blood flow
• Minimizing inflammation and modulating the immune system
• Protecting the mitochondria before the process of apoptosis is unstoppable...Neuroprotection
• Control excessive glutamate
• CONSIDER THE GENETICS RELATED TO THE PROBLEM. NEW DATA INDICATE THAT THERE ARE GENETIC INFLUENCES ON THE ABILITY TO ASSIMILATE AND UTILIZE KEY NUTRITIONAL COMPONENTS.

REPORTED RISK FACTORS and ASSOCIATIONS WITH GLAUCOMA

Modifiable issues highlighted in blue:

• Intraocular pressure
• Farsightedness
• Nearsightedness
• Excessive caffeine
• Playing wind instruments
• Diabetes
• Age
• Sex
• Trauma
• Vascular disease
• Hyper and hypotension
• Smoking
• Obesity
• Family history
• Dementia
• Erectile dysfunction
• Immune system status
• Hx ocular surgery
• Pigmentary dispersion
• Pseudoexfoliation
• Ethnicity
• Sleep apnea
• Low ICP
• Hormonal levels
• Hyperhomocysteinemia
• Oral, topical, inhaled steroids

SMOKING AND GLAUCOMA

IS THERE ABSOLUTE PROOF?

http://www.eyelessons.com/articles/item/is-there-a-significant-relationship-of-smoking-and-obesity-to-glaucoma

OBESITY (METABOLIC SYNDROME), SLEEP APNEA AND GLAUCOMA

IS THERE ABSOLUTE PROOF?

http://www.eyelessons.com/articles/item/is-there-a-significant-relationship-of-smoking-and-obesity-to-glaucoma
IS THERE ABSOLUTE PROOF?

IS THERE ABSOLUTE PROOF?

WHAT KIND OF BEHAVIOR MODIFICATION AND SUPPLEMENTS MODULATE INFLAMMATION?

- Employ an Anti-Inflammatory Diet
- Stop smoking
- Lose Weight
- Exercise
- Balance Omega 6 Intake With Omega 3 Supplementation
- Check Vitamin D Levels and Consider Supplementation
- Consider the Benefits of a High Quality Vitamin Supplement
- Consider Curcumin Supplementation
- Consider Other Immune System Modulators Like Colostrum

EXERCISE AND GLAUCOMA

THE POTENTIAL EFFECTS OF SUPPLEMENTS??? WHICH ONES???

ISSUES OF COST AND BIOAVAILABILITY

http://www.eyelessons.com/articles/item/marijuana-and-glaucoma
REMEMBER IF THIS DOESN'T WORK
SUPPLEMENTATION WON'T WORK
IS THE CAUSE

In a study of ocular hypertensives without symptoms

*Mirtogenol*-bilberries + pycnogenol significantly increased velocity of blood flow through ophthalmic arteries, central retinal arteries, and posterior ciliary arteries while lowering IOP in ocular hypertension. The lowering of IOP was synergistic with latanoprost but took 6X as long to occur.


Mechanism of Action

- Anthocyanins and procyanidins phenolic extracts—Any of a class of organic compounds with a hydroxyl group attached to a carbon atom in a ring of an aromatic compound

Mechanism of Action

- Pycnogenol improves endothelial function which is altered in POAG. REDUCES PLASMA ENDOTHELIN-1 AND ENHANCES NITRIC OXIDE

- Mirtoselect counteracts hyperpermeability of ciliary capillaries...acting on aqueous secretion

2008 Controlled Study

- 160 mg Mirtoselect
- 80 mg Pycnogenol

http://www.eyelessons.com/articles/item/mirtogenol-is-it-the-real-deal
http://www.eyelessons.com/articles/item/pycnogenol-for-diabetes-mellitus
2010 Controlled Study
• http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2447819/
• 80 mg Mirtoselect
• 40 mg Pycnogenol
• 1gtt Latanoprost

The Results - IOP

Affect of Mirtogenol™ on IOP in Ocular Hypertensives

Affect of Mirtogenol™ on Color Doppler Velocity Measurements of Ocular Arteries in Ocular Hypertensives

IOP Lowering Effect of Mirtogenol™, Latanoprost, and a Combination of the Two in a Cohort of Asymptomatic Ocular Hypertensive Patients

Diastolic Blood Flow of the Central Retinal Artery in cm/s with Mirtogenol™, Latanoprost, and a Combination of the Two in a Cohort of Asymptomatic Ocular Hypertensive Patients
The Results - Diastolic Blood Flow

The Results - Systolic Blood Flow

Summary of Facts

- At around 4-6 weeks the synergistic effects of a Prostaglandin and Mirtogenol (120 mg)
  - Increases systolic blood flow 39% Increase
  - Increases diastolic blood flow 192% Increase
  - Decreases intraocular pressure 40% Decrease
- 120 mg of Mirtogenol costs about $1

SOME STANDARDS
VITAMIN A
- Involvement in Immune System
- Potential Risk
- A recent study points to the fact that neither supplementary consumption nor serum levels of vitamins A and E were associated with glaucoma prevalence. ([Eye (Lond). 2013 Apr;27(4):487-94])
- Obtain From Diet and Good Multivitamin

VITAMIN C
- Anti-oxidant That Functions in Immune System
- Recent work has elucidated the fact that normal tension glaucoma patients have lower levels of serum vitamin C ([Graefes Arch Clin Exp Ophthalmol. 2010 Feb;248(2):243-8]) and that ascorbic acid levels are reduced in the aqueous of patients with glaucoma. ([Eye (Lond). 2009 Aug;23(8):1691-7, Clin Experiment Ophthalmol. 2009 May;37(4):402-6])
- Recent work found that vitamin C supplementation was associated with decreased odds of glaucoma but the serum levels did not correlate. ([Eye (Lond). 2013 Apr;27(4):487-94])
- Obtain From Diet and Consider for Supplementation in Poor Diets

VITAMIN D3 and Glaucoma
- FAT SOLUBLE
- The link of Vitamin D3 to glaucoma is associated with vascular perfusion issues as well as neuroprotection and the immune system
- There is even recent work suggesting topical vitamin D3 is of benefit lowering the IOP by increasing drainage in a primate model. ([Arch Biochem Biophys. 2012 Feb 1;518(1):53-60])
- Obtain From Diet, Sunlight
- There is evidence to recommend supplementation of vitamin D3 beyond that obtained in the normal diet for minimizing the risk of glaucoma damage.

VITAMIN E
- Fat Soluble Anti-Oxidant that is controversial
- Vitamin E is known to affect the expression and activity of immune and inflammatory cells, to enhance vasodilation and to inhibit the activity of the cell signaling molecule protein kinase C (PKC)
- It is estimated that more than 90% of Americans do not meet daily dietary recommendations for vitamin E. ([J Am Diet Assoc. 2004;104(10):567])
- Obtain From Diet and a Good Multivitamin
- There is some evidence to recommend supplementation of vitamin E beyond that obtained in the normal diet for minimizing the risk of glaucoma damage.
Hyperhomocysteinemia, Normal Tension Glaucoma, Blood Flow Anomalies and Optic Neuropathy have a lot in common and are often related to supplementation with Vitamins B6, B12 and Folic Acid. Recent publications have defined a relationship between plasma total homocysteine and POAG but there was no defined relationship to serum folic acid, B12 or B6. (Ophthalmology, 2012 Dec;119(12):2493-9, Curr Eye Res. 2012 Aug;37(8):712-8.) To further complicate the conclusions two years prior to this report there was found to be no association of elevated homocysteine levels in normal tension glaucoma. (J Glaucoma. 2010 Dec;19(9):576-80). Yet other findings demonstrated a relationship of elevated homocysteine only in pseudoexfoliative glaucoma and not normal tension or open angle glaucoma. (Clin Interv Aging. 2010 Apr 26;5:133-9, Graefes Arch Clin Exp Ophthalmol. 2012 Jul;250(7):1067-74, Graefes Arch Clin Exp Ophthalmol. 2011 Mar;249(S1):463-8)

**VITAMIN B6**
- Very important in enzymatic activity and immune function
- Works in concert with B12 and Folic Acid
- Obtain From Diet and Good Multivitamin...Malabsorption Issues
- Consider for Supplementation in Poor Diets or Patients with Hyperhomocysteinemia

**VITAMIN B12**
- Very important in enzymatic activity, neuroprotection and immune function...Alzheimer Disease
- Vitamin B12 deficiency is estimated to affect 10%-15% of individuals over the age of 60
- Works in concert with B6 and Folic Acid
- Obtain From Diet and Good Multivitamin...Malabsorption Issues
- Consider for Supplementation in Poor Diets or Patients with Defined or Suspected Hyperhomocysteinemia

**FOLIC ACID**
- Very important metabolism of nucleic and amino acids as well as DNA metabolism
- Works in concert with B6 and B12
- Obtain From Diet (Folate) and Good Multivitamin (Folic Acid)...Malabsorption Issues
- Consider for Supplementation in Poor Diets or Patients with Defined or Suspected Hyperhomocysteinemia

**ZINC**
- CRITICAL ENZYME
- WATCH TOXICITY
- WORKS IN CONCERT WITH B6 AND B12
- OBTAIN FROM DIET (FOLATE) AND GOOD MULTIVITAMIN (FOLIC ACID)...MALABSORPTION ISSUES
- CONSIDER FOR SUPPLEMENTATION IN POOR DIETS OR PATIENTS WITH ASSOCIATED ARM

**MAGNESIUM**
- VERY SHORT ACTING
- MAGNESIUM SEEMS TO HAVE A BENEFICIAL EFFECT ON THE VISUAL FIELD IN GLAUCOMA PATIENTS WITH BOTH INCREASED AND NORMAL IOP--POSSIBLY BY ALLEVIATING VASOSPASM AT 300 MG/DAY. MAGNESIUM ALSO WORKS TO ACTIVATE ENZYMATIC SYSTEMS. (Ophthalmologica 1995;209(1):11-3, Surv Ophthalmol 1995;40(1):61-4)
- OBTAIN FROM DIET AND GOOD MULTIVITAMIN
SELENIUM

- Critical in glutathione production
- Watch toxicity
- Obtain from diet and good multivitamin

OMEGA 3

- Source of tremendous controversy
- Eat non-contaminated fish if you can afford it
- Triglyceride base more bioavailable and more stable
- Balance with omega 6 is critical
- Support of dry eye from glaucoma GTTs
- Defined results in cardiovascular
- Known anti-inflammatory effects
- Some evidence to recommend supplementation especially in challenged diets.

CURCUMIN

- Potent immunomodulator
- Ten known neuroprotective actions
- Known to down regulate pro-angiogenic proteins
- Unless high consumption of curry must supplement to obtain effect and may be of value in glaucoma

CURCUMIN

- Decreases ROS and RNS
- Reduces microglial activation
- Decreases IL-12
- Initiates Th1 to Th2 shift
- Prevents activation of NFkB
- Regulates T cells, B cells, macrophages, neutrophils, NK cells
- Down-regulates proinflammatory cytokines and chemokines
- Recommend 500 to 1000 mg/day but bioavailability may be an issue

COLOSTRUM

- From Wikipedia
  http://en.wikipedia.org/wiki/Colostrum
  "Colostrum …is a form of milk produced by the mammary glands of mammals (including humans) in late pregnancy. Most species will generate colostrum just prior to giving birth.
- Bovine colostrum contains powerful, neutralizing agents called immunoglobulins for protection against a host of pathogens. Colostrum is also a source of other immune and growth factor components including antibodies, specific growth factors, proline-rich polypeptides, lactoferrin, leukocytes, and lactoperoxidases. It has been found that colostrum can have therapeutic effects against a variety of infections of bacterial, viral, and parasitic origin.

COMPONENTS OF COLOSTRUM

- Immunoglobulins
  - IgG
  - IgA
  - IgM
  - IgE
  - IgD
- Cytokines
- Lactoferrin
- Lysozyme
- Lactalbumin
- Lactoperoxidase
COMPONENTS OF COLOSTRUM

- Proline Rich Polypeptides
- Growth Factors
  - Epidermal Growth Factors
  - Fibroblast Growth Factors
  - Insulin-like Growth Factor
  - Platelet-derived Growth Factor
  - Transforming Growth Factors
- Vitamins
  - A, B₂, B₉, B₁₂, D

COMPONENTS OF COLOSTRUM

- Essential Nutrients
  - Carbohydrates, Lipids, Protein
- Minerals
  - Ca, Cl, Fe, Mg, P, K, Na, Zn
- Amino Acids

Science of Colostrum

- Isolation of HIV-1-Neutralizing Mucosal Monoclonal Antibodies from Human Colostrum 2012
- Hyperimmune Bovine Colostrum as a Low-Cost, Large-Scale Source of Antibodies with Broad Neutralizing Activity for HIV-1 Envelope with Potential Use in Microbicides 2012
- Randomized control trials using a tablet formulation of hyperimmune bovine colostrum to prevent diarrhea caused by enterotoxigenic Escherichia coli in volunteers 2011
- Oral administration of immunoglobulin G-enhanced colostrum alleviates insulin resistance and liver injury and is associated with alterations in natural killer T cells 2012
- Colostrum supplementation protects against exercise-induced oxidative stress in skeletal muscle in mice 2012
- Prevention of Influenza Episodes With Colostrum Compared With Vaccination in Healthy and High-Risk Cardiovascular Subjects: The Epidemiologic Study in San Valentino. 2007

What Else May Impact and Can Be Obtained From Diet or Multivitamin?

- Magnesium seems to have a beneficial effect on the visual field in glaucoma patients with both increased and normal IOP—possibly by alleviating vasospasm at 300 mg/day. Magnesium also works to activate enzymatic systems. (Ophthalmologica 1995;209(1):11–3) (Surv Ophthalmol 1995;209(1):83–4)
- Zinc
- Selenium

WHAT ABOUT MAINTENANCE OF MITOCHONDRIAL HEALTH?

Bruce Ames, the undisputed leader in the field of micronutrient impact on mitochondria, posits a new theory about homeostasis during micronutrient shortage, which, if confirmed, will radically change thinking about requirements for micronutrients and public health. His triage hypothesis offers that the risk of degenerative diseases associated with aging, including cancer, cognitive decline, and immune dysfunction, can be decreased by ensuring adequate intake of micronutrients (the 40 essential vitamins, minerals, amino acids, and fatty acids) earlier in life, a simple and inexpensive solution to a potentially large public health problem. The triage hypothesis predicts that insidious changes may indeed be occurring, providing a unifying rationale for diverse observations in the literature that suggest links between micronutrient availability, aging, and the diseases of aging. (Proc Natl Acad Sciences USA 2006;103:17589)

ALPHA-LIPOIC ACID

- FAT AND WATER SOLUBLE AND CROSSES THE BLOOD-BRAIN BARRIER
- RAISES GLUTAMATE LEVELS
- REGENERATES ANTI-OXIDANTS AND REMOVES IRON
- EVEN WHEN CHALLENGED BY TOXINS IN CIGARETTE SMOKE (Invest Ophthalmol Vis Sci. 2007;48:526)
- OBTAIN FROM DIET BUT SUPPLEMENTATION MAY BE OF VALUE IN GLAUCOMA
ACETYL-L-CARNITINE
• IMPORTANT IN COVERTING FATTY ACIDS TO ENERGY
• MAXIMIZES MITOCONDRIAL FUNCTIONS
• NEUROPROTECTIVE
• PROTECTS AGAINST GLUTAMATE
• OBTAIN FROM DIET AND MANUFACTURED BY BODY BUT SUPPLEMENTATION MAY BE OF VALUE IN GLAUCOMA

GINGKO BILOBA
• ENHANCES PERIPHERAL BLOOD FLOW WHILE INHIBITING PLATELET ACTIVATION
• ANTI-OXIDATION
• POTENTIAL SIDE EFFECTS
• MAXIMIZES MITOCONDRIAL FUNCTIONS...ENTERS MITOCHONDRIA
• NEUROPROTECTIVE
• PROTECTS AGAINST GLUTAMATE
• DIFFICULT TO OBTAIN FROM DIET BUT SUPPLEMENTATION MAY BE OF VALUE IN GLAUCOMA

COENZYME Q10
• FAT-SLUBLE ANTIOXIDANT
• HEART CENTRIC
• POTENTIAL SIDE EFFECTS
• MAXIMIZES MITOCONDRIAL FUNCTIONS...WORKS AT MEMBRANE
• NEUROPROTECTIVE
• OBTAIN FROM DIET BUT SUPPLEMENTATION MAY BE OF VALUE IN GLAUCOMA ESPECIALLY IN CASES OF CARDIOVASCULAR COMPROMISE

MELATONIN
• HORMONE ACTING AS AN ANTI-OXIDANT
• CURRENT EVIDENCE SUGGESTS THAT MELATONIN MAY ACT AS A PROTECTIVE AGENT IN OCULAR CONDITIONS SUCH AS PHOTO-KERATITIS, CATARACT, GLAUCOMA, RETINOPENHONY OF PREMATURE AND ISCHEMIA/REPERFUSION INJURY. ([J Pineal Res 2006;40:101]
• "BUT MODERATE AND SEVERE GLAUCOMA DOES NOT APPEAR TO BE ASSOCIATED WITH ABNORMAL MELATONIN CONCENTRATIONS IN AQUEOUS HUMOR." ([Ann Ophthalmol 2006;143:323])
• POTENTIAL SIDE EFFECTS
• POSITIVELY EFFECTS MITOCHONDRIAL HEALTH
• OBTAIN FROM DIET BUT SUPPLEMENTATION MAY BE OF VALUE IN GLAUCOMA ESPECIALLY IN CASES OF TREMENDOUS DIURNAL VARIATION

TAURINE
• 50% OF FREE AMINO ACID CONTENT OF RETINA
• POTENT ANTI-OXIDANT
• COUNTERBALANCES GLUTAMATE
• NEUROPROTECTANT
• POSITIVELY EFFECTS MITOCHONDRIAL HEALTH
• OBTAIN FROM DIET BUT SUPPLEMENTATION MAY BE OF VALUE IN GLAUCOMA

N-ACETYL CYSTEINE
• AMINO ACID ULTIMATELY CONVERTED TO GLUTATHIONE
• POTENT ANTI-OXIDANT
• ASSISTS IN REGENERATION OF VITAMINS C AND E
• ACTS AS A CHELATING AGENT...ZINC COPPER ISSUES
• NEED EXTRA VITAMIN C
• POSITIVELY EFFECTS MITOCHONDRIAL HEALTH
• OBTAIN FROM DIET BUT SUPPLEMENTATION MAY BE OF VALUE IN GLAUCOMA BUT SIDE EFFECTS MAY OUTWEIGH POTENTIAL BENEFITS
RESVERATROL

• POLYPHENOL
• POTENT ANTI-OXIDANT
• NEUROPROTECTANT
• POSSIBLE EFFECT ON CLOTTING
• POSITIVELY EFFECTS MITOCHONDRIAL HEALTH
• OBTAIN FROM DIET BUT SUPPLEMENTATION MAY BE OF VALUE IN GLAUCOMA BUT SIDE EFFECTS MAY OUTFLOWE POTENTIAL BENEFITS

RESVERATROL

THERE IS NEITHER A MAGIC PILL NOR A MAGIC NUTRICEUTICAL, BUT RATHER A MENTAL SET AND LIFESTYLE THAT SET THE TONE FOR MAXIMIZING HEALTH.

Complexity + Cost = Failure

REQUISITES FOR SUCCESS

• EASY TO TAKE...SMALL AND SLICK
• MINIMAL SIDE EFFECTS
• TAKE WITH FOOD
• COSTS LESS THAN $1.00/DAY

<table>
<thead>
<tr>
<th>Desirable Minimal Supplements in a Daily Multivitamin</th>
<th>Beneficial Action</th>
<th>Recommended Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Quality Multivitamin with 400 mcg Folic Acid, 2 mg B6 6 mcg B12.</td>
<td>Anti-Oxidation, Balance and Control of Homocystine</td>
<td>q.d. or b.i.d. based on brand. Folic acid competes with methotrexate.</td>
</tr>
<tr>
<td>Vit E, based on AHA recommendations.</td>
<td>Anti-Oxidation</td>
<td>300IU/day</td>
</tr>
<tr>
<td>Vit C</td>
<td>Anti-Oxidation, Immune System Modulation</td>
<td>500 to 1000mg/day</td>
</tr>
<tr>
<td>Vit A</td>
<td>Immune System Modulation</td>
<td>Under 3000 micro grams/day</td>
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<tr>
<td>Zinc</td>
<td>Immune System Modulation</td>
<td>15 mg/day</td>
</tr>
<tr>
<td>Selenium</td>
<td>Antioxidants in Glutathione Production</td>
<td>100-200 mcg/day</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Antioxidants in Glutathione Production</td>
<td>420 mg/day men 320 mg/day women</td>
</tr>
<tr>
<td>Lutein and Zeaxanthin</td>
<td>Anti-Oxidation</td>
<td>Lutein 10 mg/day and Zeaxanthin 2 mg/day</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Desirable Extra Minimal Supplements</th>
<th>Beneficial Action</th>
<th>Recommended Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triglyceride Backbone Omega 3</td>
<td>Immune System Modulation</td>
<td>1000 mg b.i.d. but no recommended RDA</td>
</tr>
<tr>
<td>Vitamin D3</td>
<td>Neuroprotection, Immune System Modulation</td>
<td>500 IU b.i.d. with RDA in flux as measurement of blood levels becoming more important</td>
</tr>
<tr>
<td>Mirtogenol</td>
<td>Reduces IOP, Increases Vascular Flow</td>
<td>Mirtogenol (40 mg Pycnogenol® and 80 mg Mirtosel®) q.d.</td>
</tr>
</tbody>
</table>

Now Let's Get Real From a Cost and Compliance Standpoint
THE GLAUCOMA FORMULA BASED ON SYNERGISTIC USE OF THE MULTIVITAMIN WITHOUT INTRODUCING POTENTIAL SIDE EFFECTS

- **VITAMIN C (ASCORBIC ACID)…500 MG**
- **Ω 3…1000 MG TRIGLYCERIDE BACKBONE**
- **VITAMIN E (D-ALPHA TOCOPHERYL SUCCINATE)…200 IU**
- **MIRTLOSELECT…80 MG**
- **PYCNOGENOL…40 MG**
- **CURCUMIN…500 MG**
- **LIPOIC ACID…500 MG**
- **ACETYL-L-CARNITINE…400 MG**
- **CO-ENZYME Q10…100 MG**
- **TAURINE…2 GRAMS**

CRITICAL COMPONENTS OF THE MULTIVITAMIN FOR SYNERGISM WITH THE GLAUCOMA FORMULA ARE HIGHLIGHTED

- **VITAMIN A…2500IU**
- **VITAMIN C…90 MG**
- **VITAMIN D…500 IU**
- **VITAMIN E…50 IU**
- **VITAMIN K…30 MCG**
- **THIAMIN…1.5 MG**
- **RIBOFLAVIN…1.7 MG**
- **NIACIN…20 MG**
- **VITAMIN B6…3 MG**
- **FOLIC ACID…500 MCG**
- **VITAMIN B12…25 MCG**
- **BIOTIN…30 MCG**
- **CALCIUM…220 MG**
- **PHOSPHORUS…110 MG**
- **IODINE…150 MCG**
- **MAGNESIUM…50 MG**
- **ZINC…11 MG**
- **SELENIUM…55 MCG**
- **MANGANESE…2.3 MG**
- **CHROMIUM…45 MCG**
- **MOLYBDENUM…45 MCG**
- **CHLORIDE…72 MG**
- **POTASSIUM…80 MG**
- **LYCOPENE…300 MCG**
- **LUTEIN…250 MCG**
- **BORON…150 MCG**
- **NICKEL…5 MCG**

BEHAVIOR, NUTRITION, AND GLAUCOMA...ADVICE

- **CONTROL YOUR WEIGHT**
- **EXERCISE**
- **DON'T SMOKE...NOT EVEN**
- **WATCH INTAKE OF INFLAMMATORY FOODS...HEALTHY DIET**
- **CONTROL HYPERTENSION, GLYCEMIC LEVELS AND CHOLESTEROL**
- **ELIMINATE STRESS**
- **PICK BETTER PARENTS**
- **SUPPLEMENTATION WHEN NECESSARY**