

# How to Enhance Immunity with Diet

#### How dietary choices can enhance your life!

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#### COVID-19, a SARS corona virus

- To enhance immunity against viruses, we need to enhance macrophages and NK cells (part of TH1 immunity), while finding a balance in inflammatory cytokine response to prevent cytokine storms.
- COVID 19 has dramatic effects on the endothelium, primarily by binding ACE2, which dramatically increases ROS. Need to counteract these effects as much as possible.
- Impact of individual nutrients on immune function, tissue health and/or effects on treatment efficacy

# What Are Our Primary Goals/Needs?

- General nutritional intake/status of micronutrients
  - Affects several immune mechanisms, tissue health and even tx
- Control Inflammation
  - Direct measures for: CRP, adiponectin, myeloperoxidase.
  - Indirect indicators: lipids, glucose, insulin, body fat and weight

#### Improve Immune Markers

- Indicators: VEGF (also an indicator of inflammation) suppresses NK cells
- Granulocytes Monocytes, Eosinophils, Basophils
- T cells /Lymphocytes an important primary indicator of immune potential.
  T cells decline with age.

### Individual Nutrients: Vitamin A

- Vit A retinoic acid (RA) shows the most biological activity, known as "anti infective" vitamin, needed for healthy epithelial tissue, mucosal linings. Immune organs (bone marrow, thymus, spleen) need constant intakes
- RA induces T Cell migration
- All trans RA pushes macrophage production more toward anti inflammatory M2 macrophages
- RA inhibits IL-6 production and T reg cells, thus playing a role in preventing autoimmunity

# Vitamin A Sources (RDA 700 mcg, 900 mcg RAE/day. TOL 3000 mcg/day)

- Preformed Retinoids (retinol, retinal, retinoic acid) Eggs, cod liver oil, fish, shrimp, butter, liver
- Beta carotene and other carotenoids less easily digested and absorbed, must be converted to retinol and from there to retinal and retinoic acid. Cooking helps as does pureeing. Conversion is neg affected by increased body fat, low dietary fat intake. Sources: Yellow, Orange and Green vegetables (pumpkin, carrots, sweet potato, squash, kale. collard greens)

#### Zinc

- Needed for development and function of immune cells, including T and B cells.
  Sometimes described as a gatekeeper for immune fx
- All enzyme classes need zinc, ie transferases, lyases, etc
- Need for formation of proteins
- Needed for metallothioneines (reg mineral transport and homeostasis, play role in oxidative stress, heavy metal detox)
- During inflammation zinc transfers from serum to organs (probable reason for sudden loss of taste and smell), leading to dramatically increased need for zinc.
- Seems to inhibit viral replication (incl coronavirus) and shorten duration of colds if given within 24 hr onset of symptoms.
- Needed for SOD -

### Zinc – RDS 11 mg/d in men, 8 mg/d in women

- Severe deficiency is rare, marginal deficiency very common
- Dietary sources more bioavailable sources, red meat (9 mg/3 oz), oysters (40 mg/6 ea), and other shellfish, dark meat turkey, and pork. Plant sources – soybeans, pumpkin seeds (2 mg/oz) and other nuts/seeds, chickpeas (avg 1 -2 mg/svg)
- Beans and whole grains have high phytates, which block the absorption. Soaking, sprouting and fermenting helps reduce phytates.
- Caution with high dosages longer term due to copper deficiency

#### Vitamin C

- Stimulates production of WBC, especially neutrophils, phagocytes, lymphocytes
- Antioxidant protect against oxidative stress
- Anti viral, especially in higher dosages (I.V.)
- Sources: fruits and veg's, especially bell peppers, cantaloupe, kiwi, broccoli, papaya, snow peas, oranges, strawberries, grapefruit, clementines, kale, sweet potatoes.

### Lymphocytes

- Make up 85% of WBC
- Low can be due to HIV/AIDS, autoimmunity, some CA, CA tx, steroid use, stress and undernutrition
- Vitamin C primary nutrient that increases lymphocytes

### Vitamin D and Fish Oil

 Vit D – drives production of innate immune cells and anti microbial proteins, has inhibitory effect on adaptive immunity, B cell antibodies. Can also inhibit T cells. Immune modulator

• Fish Oil – modulatory and anti inflammatory

https://lpi.oregonstate.edu/mic/health-disease/immunity

#### **Other Micronutrients**

- Manganese needed for SOD. Sources: Nuts/seeds, beans/legumes, steel cut oatmeal, brown rice, green leafies, pineapple, dark chocolate.
- Iron needed for oxygen transport, needed for catalase enzyme ( important for protection against ROS). Needed for thyroid hormone conversion. Need adequate amounts. Avoid excessive intake (heme iron incr risk for diabetes.)
- Copper SOD, thyroid, energy prod in mitochondria, iron conv for transport, immune fx declines w/def. Liver, oysters, shitake mushrooms, nuts/seeds
- Selenium glutathione peroxidase is a selenoprotein, regulates cytokine and ecosanoid production. Brazil nuts, tuna, shellfish, pork, beef, chx, whole grains, shitake mushrooms

# Role of Inflammation in Covid-19

- Covid 19 wipes out ACE 2, causes dramatic increases in superoxide production. Superoxide increases more as neutrophils increase.
- No ACE 2 means ATII builds up. ATII increases superoxide production dramatically.
- Krebs cycle, ATP prod need oxygen to accept electrons from the process and ultimately produce water. Oxygen delivery is compromised due to lung tissue damage.
- Need SOD to lower superoxide, Catalase to lower H2O2, and Glutathione to lower OH radicals, and convert H2O2 to water.
- Excessive calorie intake leads to build up of NADH/FADH, in an oxygen deficit situation.
- Diabetes and overweight/obese, builds up ROS in body (depletes antioxidant/anti inflammatory enzymes.)

### Supporting Glutathione and Nitric Oxide

- Glutathione made from 3 amino acids and sulfur compounds. Sources: Asparagus, cabbage family vegs, avocado, spinach, garlic, chives. Cooking reduces the glutathione by 30-60%. Lightly steam these veg's and add garlic and chives after other ingredients in foods are cooked.
- Nitric oxide provides important countermeasure to increased ATII to reduce superoxide production. Sources: beets, green leafies, most veg's. Do probiotics and other microbiome support to prevent conversion of dietary nitrates into nitrosamines. Arginine – drives nitric oxide production. Sources: animal proteins, nuts and seeds, legumes, seaweed (Be careful not to overdo intake in people with Herpes. Counterbalance with lysine.)

### **Controlling Inflammation**

- Manage blood glucose and insulin carb managed diets and other dietary measures, glucose-support supplements
- Manage MEB's food allergy/sensitivity (gut health), low allergen diet
- Manage weight controls inflammatory signaling from fat cells, supports adiponectin production. Carb modification, support gut health (for good GLP-1 and PYY), may need low allergen diet. Protein at breakfast helps control morning glycemic response, leads to 500 kcal less per day on avg.

# **BLOOD GLUCOSE REGULATION**

# Number 1 dietary factor causing Inflammation

- Post meal dysglycemia
- The highly processed, calorie-dense, nutrient-depleted diet, common in the US causes dramatic spikes in blood glucose and insulin after eating
- High intake of refined flour and sugars and/or a lot of fat, ie as seen in fast foods
- Goes on to cause immediate oxidative stress in the blood vessels

# The Fires of Inflammation from Dysglycemia

- Too much fat and sugar = oxidative products that reduce nitric oxide (helps blood vessels dilate), increases adhesion molecules making blood stickier
- Oxidized LDL is an indicator of how much post meal oxidative stress is occurring
- Small particle cholesterol = damaged blood vessel linings
- Immune cells and cholesterol come to site of damage trying to repair, but immune activity makes the plaque prone to breaking off and causing a clot (vulnerable plaque)
- Glucose binds to cells (like hemoglobin) and causes advanced glycation end products (AGE's)

### The Fires of Inflammation from Dysglycemia

- Usually this inflammation is "silent" not manifesting as pain, but as Metabolic Syndrome, High BP, High bl glu, High chol, which can go on to become hypertension, heart ds, and diabetes
- And can go on to cause pain angina or neuropathy,
- Can damage other tissues like macula and retina
- Type 2 diabetes increases risk for Alzheimer's and vascular demetia. Alzheimer'shas been described as type 3 Diabetes
- AGE's thought to accumulate in joints, causing changes to cartilage and can lead to damage and osteoarthritis

# Anti Inflammatory Diet Study

- Avoid highly processed foods and beverages, particularly those containing sugar, high-fructose corn syrup, white flour, or *trans* fats.
- Select high-fiber carbohydrates with low glycemic index, including vegetables, fruits, whole grains, legumes, and nuts. (These foods provide the most antioxidants and trace minerals to support SOD and fight all the increased ROS present in COVID 19)
- At all 3 meals, consume lean protein.
- Eat approximately 1 handful of nuts daily (using a closed fist), consumed with vegetables, grains, berries, or other fruits.
- Eat salad daily, consisting of leafy greens with dressing of vinegar and virgin olive oil.
- Limit portion sizes to modest quantities (usually needs to be more specific)
- Lose weight we need help people know how to do that!

# Adiponectin

- Improves insulin sensitivity helps glucose, insulin, and leads to ability to burn fat for energy/fat loss
- Has anti-inflammatory effects inhibits LPS stimulated cytokine expression
- Reduces TNFa, enhances Nrf2, helps activate autophagy

### Effects of Calorie Restriction & Macronutrient %

- Calorie restricted diet with exercise improves adiponectin most significantly, avg 30% incr
- Lowest calorie diets did not improve adiponectin. Moderate calorie restriction increased it in some cases
- Calorie restriction directly enhances T cell production
- Low fat and Low CHO 20 25%, both incr adiponectin somewhat
- Low fat vs Low CHO more wt loss with low carb diets despite adiponectin increase in low fat diets.
- Fat type watch saturated fat intake in people with ApoE ¾ genes drives inflammatory response and reduced insulin sensitivity

#### Enhancing Adiponectin with Exercise

 Exercise study in 260 males - brisk walking/light jogging 40 min,
 4- 5 days per wk increased adiponectin 260% initially, then it levels off

#### **Enhancing Adiponectin Production with Diet**

- Low glycemic load/high fiber diet reduced intake of starches and sugars incr adiponecton 18%, more high fiber foods incr 19%.
- Fiber supplements at labeled dosages increased levels 60 115%.
- Non starchy veg's intake positively correlated. (All veg's except peas, corn, potatoes. Celery, carrots, cucumbers, asparagus, broccoli, cauliflower, brussels sprouts, green beans, etc.) Increased F & V intake also led to modest increase in adiponectin.
- Omega 3 fats (help PPARs) daily intake increased levels 15-60%
- High fat diets reduce adiponectin production likely due to the lack of fiber/resistant starch in beans and oats, etc and subsequent loss of SCFA production in the gut (loss of GLP-1)



# High Glycemic Foods





# Low Glycemic Foods



















#### Enhancing Adiponectin with Diet

- Magnesium RDI 400 mg/day. Magnesium intake positively correlated with adiponectin
- Dietary sources are . . .
  - Beans/legumes 120 mg/cup, also help with fiber intake
  - Leafy greens ex spinach 78 mg/half cup
  - Dark chocolate (low sugar) 64 mg/oz
  - Nuts/seeds varies by type, avg 60 80 mg/ oz, pumpkin seeds 160 mg/oz, Brazil nuts – 125 mg/1/4 cup
  - Avocado 58 mg/ 1 med
  - Salmon and halibut 25 mg /3 oz.

# Effects of Alcohol- Conflicting Impacts

- Increases adiponectin
- Alcohol nutrient depletions Vit A, B1, folate, niacin, iron, magnesium, zinc
- Influences essential fatty acid processing
- Women seem more prone to effects of alcohol possibly due to effects on nutritional status from pregnancy, lactation and birth control (depletes B vits, folate, Co Q 10, zinc, selenium, vit C,)

# **IMMUNE REGULATION**

# Medications, Diet, Gut Health, Immunity

- Many medications disrupt microibiome, reducing beneficial flora, which can lead to candida overpopulation
- Sugar promotes overgrowth of yeast (dampens T cell response)
- Probiotics regulate immune response in intestines, promote SCFA contributing to better GLP-1, PYY
- Resistant Starch is the number one dietary factor that promotes beneficial flora populations
- High plant food intake promotes diversity of strains

# Allergenic Proteins and Immune Response

- Lack of probiotic colonization in the gut results in immune cell activation
  - Pro-inflammatory cytokines
  - Immune cells mature into antibodies, IgG, IgA, IgE that also produce inflammatory cytokines
  - Inflammatory cytokines = inflammation, contribute to accelerated aging process, chronic disease, and can cause pain

Ghoshal UC, Ghoshal U. Trop Gastroenterol. 2007;28(2):43-4



Intestinal TH2 Overactivity:

- Antibiotics/meds wipe out beneficial flora (probiotics)
- Probiotics control your immune cells in gut via production of tight junction proteins
- Stress impacts tight junction proteins
- Without probiotics to direct, antibodies start reacting to food and env allergens Cytokines damage tissues cause symptoms

# Food Sensitivity and Autoimmunity

• Food sensitivities – a missing link in autoimmune conditions like Hashimoto's thyroiditis, arthritis, psoriasis or Sjogren's, IBS

 Among the most reactive food epitopes are caseine, cow milk, wheat, gliadine, white of egg and rice. A variable reaction can be seen on nuts e.g.; walnuts and almonds. Almost no antibody reaction is noticed on vegetables, fish and meat products,

# **Vegetarian Diets**

- Vegetarians higher intake of many nutrients ie carbs, omega 6 fa's, vit C, Vit E, fiber, and Mg, but lower in pro, sat fat, omega 3, retinol, B 12, zinc
- Vegans all above and very low in B 12 and calcium
- Vegetarians have higher homocysteine compared to meat eaters
- Vegetarian diets caution: if too many high glycemic foods, increases risk for heart disease

# **Vegetarian Diets**

 Animal proteins are the best sources of zinc, selenium, preformed vit A, B 12 (needed for synthesis of hemoglobin), iron, and B 12, nutrients necessary for strong immune system function

# Vegetarian Diet Immune Effects

- Vegetarians had significantly lower white and red blood cell counts
- Significantly lower phagocytosis of monocytes and granulocytes in an older vegetarian population (vs. older nonvegetarians (P < 0.05, P < 0.001).</li>
- Decreased phagocytic activity of granulocytes in younger vegetarians.
- Regardless of age, respiratory burst of phagocytic cells was also significantly decreased in women vegetarians versus nonvegetarians (P < 0.05, P < 0.001).</li>
- Older vegetarians revealed significantly suppressed proliferative response of T-lymphocytes to mitogens (P < 0.001).</li>

# MCD MyPlate

Breakfast Protein Shake OR. Eggs with Veggies OR Breakfast Meat with Veggies



Fruit

1-2 servings/day can be eaten with: -breakfast -nuts/seeds as a snack



-a square of dark chocolate in the evening -non-dairy whipped topping

Women: 1 serving/day | Men: 2 servings/day

#### **Healthy & Easy Snacks**

(between or added to meals): -nuts/seeds -V-8 juice -kale chips

-veggies & hummus -celery & almond butter



Lunch- Can add a serving of Jilz crackers Dinner- Add 1 or 2 starch servings

Healthy Fats should be included with each meal.

#### DAY 1

#### **Sample Meal Plans**

#### DAY 2



Breakfast- Avocado protein shake

Lunch- Large salad with chicken and olive oil vinaigrette dressing, and Jilz crackers

Dinner- Bowl of chili, side salad with dressing and steamed asparagus with butter

Evening snack- Berries with non-dairy whipped topping

#### Breakfast- Eggs w/veggies & turkey sausage

Lunch- Grilled chicken salad with dressing, carrots, blackberries and nuts

Dinner- Grilled salmon/fish, steamed asparagus with mushrooms, and side salad topped with sunflower seeds, olive oil, and vinegar

Evening-1 square of dark chocolate with tea



# All Paths Leading to a True Anti-Inflammatory Diet and

#### Strong Immune System

- Reduction of high glycemic carbs for weight mgmt and better control of blood sugar and lipids.
- Allergen elimination when sensitivities present will modulate immunity and decrease inflammation
- Diet customized to the individual carb amt per tolerance and allergens
- Focuses on getting enough fiber and resistant starch
- Emphasizes high plant food intake, resistant starch, nuts/seeds
- Includes some animal proteins, fish oil
- Avoid high fat, very low carb/low fiber diets due to impact on gut health
- Organic foods many food chemical suppress immunity, promote insulin resistance, and reduce thyroid activity



# Integrative Health Programs

- Thorough eval of chemistry blood sugar and inflammatory markers, stress and other hormones
- Address metabolic issues, thyroid, pancreas, gut, etc
- Diet and nutrients to balance that chemistry and get it heading back in the right direction.

### How To Enhance Immunity with Diet

# THANK YOU!

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