The Pathogen Pathway: Inflammation and The Oral Systemic Link

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Course Objectives:
• Learn the latest research on the relationship between oral pathogens and inflammation in the body
• Examine the association between poor oral health and many systemic issues, such as heart attack and strokes, cancer, obesity and sinus issues.
• Review the potential link between poor oral health and brain diseases
• Describe the bidirectional link between poor oral health and diabetes and respiratory diseases
• Identify opportunities for medical-dental collaboration

Why?

• Think it’s just about brushing and flossing…Think again
• Public health crisis
• High risk lifestyles
• Dentistry can be prevention and education specialists
• If not you, who? and if not now, then when?
• Inflammatory cells are present, even if clinical symptoms are not visible
• Chronic Inflammation may be the root cause for most diseases

Functional Medicine: A New Operating System for 21st Century Healthcare

• Old model: (treat symptoms and body parts)
• New Model: (treat whole body, not WHAT but WHY?)
• Dr. Hyman, Dr. Roizen, Dr. Axe, Amy Doneen, Dr. Bale, Dr. Fuhrman

• All body parts and organs are connected via the blood stream
• The lymphatic system, endocrine system, nervous system, GI system + the immune system
• Separation of BODY PARTS does not exist
• What happens in one body part affects the entire body

https://baledoneen.com/blog/the-oral-systemic-connection-how-bacteria-in-your-mouth-can-harm-your-heart/
https://baosh.org/finding-the-root-cause-of-disease-is-all-controllable/
PERIODONTAL DISEASE IS NOT A LOCALIZED DISEASE

• Inflammation is the key driver
• Immune System
• Examine all sources of inflammation in the body
• We treat periodontal disease as a localized disease but it is a systemic disease.
Periodontal disease is often the first visible sign of chronic inflammatory diseases such as diabetes.
*Periodontitis is a sign of poor glycemic control

SCREENING: THE MOUTH AS THE GATEWAY TO THE BODY

Screening should include:

• Caries Risk
• Periodontal Assessment and period risk
• Medical/social history
• Oral cancer screening and risk assessment
• Screening for deep aperae, ankylosis, mouth breathing
• Screening for identity, weight
• Acid Reflux
• Diet/nutrition and stress, sleep
• Resistance, hormones
• Infections, food allergies and sensitivities
• GI disturbances

Identify underlying inflammation to help identify or prevent treat:

• Inflammation
• Headaches
• Heart attack, stroke
• Obesity
• Cognitive decline
• Alzheimer’s
• Cancer (breast, lung, prostate, stomach, gallbladder, skin)
• Metabolic syndrome, Diabetes

ORAL-SYSTEMIC LINK: THE LAST 70 YEARS!

How?
1. Chronic inflammation in mouth increases inflammatory markers in bloodstream affecting immune response, or adding to the body’s general burden of disease.
2. Oral cavity may act as a reservoir for pathogenic bacteria that can enter the bloodstream and affect distant site or systemic pathogens (systemic endotoxemia or bacteremia).

Association-Not Cause (yet!!)

• While a number of associations have been found between poor oral health and systemic conditions, finding direct causality remains elusive.
• Poor oral health and systemic diseases share many common risk factors, including smoking and poor diet.


microbiome

more than 100 systemic diseases and upward of 500 medications have oral manifestations
• a unique population of 500-700 species of bacteria, viruses, fungi, and protozoa, a good number of which are significantly virulent and many of which have not been cultivated.

The oral cavity is also bathed in a complex mixture of fluids, composed primarily of saliva and gingival crevicular fluid, that plays a major role in maintaining a healthy oral environment.

• Individuals with good oral hygiene tend to have a simple flora dominated by gram-positive cocci and rods and some gram-negative cocci.
• Those with poor oral hygiene have a shift to a more diverse and complex flora dominated by anaerobic gram-negative organisms.

How much does it weigh?
1. 1 ounce
2. 8 ounces
3. 1 - 2 pounds
4. 3 - 4 pounds

Bacteria, Viruses and Fungi-OH MY!

C. albicans partners with Streptococcus gordonii, S. oralis, and S. sanguinis to enhance bacterial colonization and biofilm formation.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6292568/
https://journals.plos.org/plospathogens/article/file?id=10.1371/journal.ppat.1007342&type=printable
https://www.cdc.gov/fungal/diseases/index.html

Bacterial + Fungal = CROSS-KINGDOM INTERACTIONS
*dental caries (tooth decay)
*mucosal infections

Bacterial + Viruses = CROSS-KINGDOM INTERACTIONS
*oral cancer
*periodontal disease
The Role of Viruses in Oral Disease

Viruses create ulcerations in tissues
- Viral infections lead to production of cytokines and increased inflammation in tissues
- HPV
- CMV
- EPV
- HSV1
- HSV2
- HHV 8

Viral infections lead to production of cytokines and increased inflammation in tissues

Viruses linked to oral cancer and periodontal disease, more severe tissue destruction—more harmful burden on immune system
- Innovations
  - Anti-herpes medication may be helpful in treating periodontal disease
  - HPV Vaccination to prevent oral cancer

Due to poor oral hygiene
- Gram-negative anaerobic bacterial infection, chronic periodontitis is closely associated with human cytomegalovirus and Epstein-Barr virus co-infection.
- It is supposed that these viruses act together to control immune response to bacterial challenges; these viruses and bacteria act together to lead to low-degree chronic inflammation and carcinogenesis.
- Periodontal disease is associated with an increased production of reactive oxygen species which, if not buffered sufficiently, cause damage to the host cells and tissues.
- The byproducts of the oral inflammation enter the bloodstream, which may enhance cellular proliferation and mutagenesis, allowing for the development and spread of cancer.

Do you have HPV in your mouth?
1. HPV’s are common in oral samples such as biopsies or brush samples of mucosa
2. One laboratory reported that 95% of superficial scrapes from healthy mouths were positive
3. Typically reported to be higher in biopsies from oral lesions such as leukoplakia or cancers.

Viral activity in periodontal tissues may impact the local immune response in a way that benefits opportunistic bacteria, and thus leads to aggravated symptoms
- Viral–bacterial interactions
- Herpesviruses are well known for their capacity to manipulate the immune system
- viruses produce cytokines
- Human papillomavirus (HPV) is a DNA virus that can cause chronic infection of either skin or mucosal epithelium.
- Aphthous ulcers—no single viral link has been found, but association has been linked to 28 viruses

Link between Herpes Strain and Developing Multiple Sclerosis

Porphyromonas Gingivalis

Prevalence of Anaerobic Bacteria (P. gingivalis) as Major Microbial Agent in the Incidence Periodontal Diseases by Meta-analysis

Porphyromonas gingivalis is a Gram-negative anaerobic bacterium and is considered to be a major pathogen associated with periodontitis
Acute Inflammation

- Complex, biological response of the body to harmful stimuli
  - Pathogens
  - Damaged cells
  - Irritants
- A protective response
  - Inflammation cells, blood vessels
  - Molecular mediators
- Reduce/repair damage
  - Eliminate the initial cause of injury
  - Clear out necrotic cells and tissues damaged from injury and inflammation process
  - Initiate healing

Inflammation: Acute vs. Chronic

- Acute and Chronic
  - A: initial response
    - Increased movement of plasma, leukocytes (granulocytes) and various cells
    - Increased movement from blood to injured tissue
  - B: prolonged inflammation
    - Shift progressive changes in the type of cells present at the site of inflammation, such as mononuclear cells and characterized by simultaneous destruction and healing of the tissue from the inflammatory process.

The body’s white blood cells and substances they produce protect us from infection when foreign organisms, bacteria and viruses are present

Autoimmune
- mediated by leukocytes (granulocytes)
- neutrophils must be able to move from within the blood to the inflamed tissue
- some ingest bacteria (phagocytes)
- some release enzymes to damage pathogenic invaders

Chronic inflammation
- mediated by monocytes and lymphocytes

Acute Mediators
- Pro-inflammatory mediators
  - IL-1, IL-6, TNF-α, MMPs, ROS
- Anti-inflammatory mediators
  - IL-10, VEGF, TGF-β

Autoimmune
- Neutrophils must be able to move from the blood to the inflamed tissue
- Ingest bacteria (phagocytes)
- Release enzymes to damage pathogenic invaders

Inflammatory Disorders-Examples

- Acute
  - Asthma
  - Autoimmune
  - Autoinflammatory diseases
  - Celiac disease
  - Prostatitis
  - Diverticulitis
  - Rhinitis
  - Atherosclerosis

- Chronic
  - Hypersensitive (hay fever, food allergies, allergies or sensitivities)
  - Inappropriate immune response triggering inflammation, vasodilation and nerve irritation
  - Severe end of spectrum is anaphylaxis
  - IBD
  - Lichen Planus
  - PID
Pharmacological

- Certain drugs or compounds are known to affect inflammation
- Vitamin A deficiency causes an increase in inflammation response
- Anti-inflammatory drugs work by inhibiting enzymes that produce inflammatory eicosanoids.
- Illegal drugs like cocaine and ecstasy may exert determinate effects by activating transcription factors intimately involved in inflammation NF-κB
- Steroids can stimulate cancer cells or sometimes suppress them
- Vitamin D
- Vitamin B

Inflammation-Cancer

- 1863 - Rudolf Virchow
  - Origin of cancer is at sites of chronic inflammation
  - 2020: chronic inflammation is estimated to contribute up to 25% of all cancers

Anti inflammatory Mediators

- Messenger that acts in blood vessels and cells to promote an anti-inflammatory response
- Inflammatory mediators: IL-1β, TNF, IL-6, IL-15 and chemokines contribute to neoplasia
- Orchestrate an environment that fosters cell proliferation and cell survival
- Inflammation also cause cell and DNA damage and introduce reactive oxygen species

Cancer

- A normal cell may undergo carcinogenesis to become a cancer cell if it frequently subjected to DNA damage during chronic inflammation. DNA damages may cause genetic mutations
- A human cancer cell may possess 1802 mutations, 10-20 of them are driver mutations and linked to cancer development.
- More likely, chronic inflammation may lead to DNA methylations; several hundreds, or thousands of cancer cells are genes are methylated in a single cancer cell. Oxidative damage happens and cells recruit complexes of DNA methyltransferases.

Resolution of Inflammation

- Inflammatory Response must be actively terminated
- Failure to do may result in chronic inflammation and cell death
- Production and release of TGF and macrophages
- IL 10
- Anti-inflammatory mediators
- Degradation of pro-inflammatory molecules
- Desensitization of receptors
- Increased survival of cells in area of inflammation
- Acute normally resolves by mechanism that may remain elusive

Systemic Effects

- An infectious organism can escape the confines of the immediate tissue via the circulatory system or lymphatic system
- When inflammation overwhelms the host
  - Systemic inflammation
  - Bacteremia
  - Septic shock
  - Death

Poor Oral Health And Diseases of the GI Tract

- Mouth and Throat (beginning)
- Liver
- Stomach
- Pancreas
- Colon
- Rectum/Anus (end)
Oral and Oropharyngeal Cancers

- esophageal cancer
- associations were also found between poor oral health and lung, gallbladder, breast, and skin cancer
- With each mm of bone loss: 5.23x more like to develop tongue cancer

Poor Oral Health and the Liver

- Fusobacterium nucleatum
- T. denticola
- A. actinomycetemcomitans
- originates in the oral cavity

Poor Oral Health and the Stomach

- T. denticola
- A. actinomycetemcomitans
- T. forsythia
- Less bacterial diversity in their saliva
- Not flossing regularly significantly predicted an increased risk for precancerous lesions of gastric cancer

Stomach Cancer

- Based findings: Treatment for chronic periodontal disease and control of periodontal pathogen infections should be included in future strategies for preventing stomach cancer
How a common oral bacteria makes colon cancer more deadly

Researchers have determined how a type of bacteria commonly found in the mouth accelerates the growth of colon cancer.

F. nucleatum -- a common oral bacteria often implicated in tooth decay -- accelerates the growth of colon cancer.

Scientists have also demonstrated that about a third of colorectal cancers are associated with a common oral bacterium called F. nucleatum. Those cases are often the most aggressive, low or lower-middle income groups have higher BMI.

Future study on this topic

https://www.sciencedaily.com/releases/2019/03/190304100009.htm

Oral health and risk of colorectal cancer: results from three cohort studies and a meta-analysis-2016

Colorectal cancer (CRC) is the third most common cancer in both men and women worldwide.

- New cases each year
- Men: 132,700 and 376,300 Women
- Inflammatory bowel disease is one established risk factor
- Several other known or suspected risk factors

- Smoking
  - dietary fat intake
  - obesity and physical inactivity are known to be associated with systemic inflammation suggesting that inflammation plays a major role in CRC development.

- Poor Oral Health
- Missing Teeth
- Poor Diet (high fat, low fiber)
- Obesity
- Alcohol
- Tobacco
- Genetics

*Men, African American Women

https://academic.oup.com/annonc/article/27/7/1329/1741878

PANCREAS

- Gland Organ
- Secretes enzymes, digestive juices into the small intestine
- Breaks down food left in the stomach
- Produces the Insulin hormone and secretes it into the blood (there it regulates the body's glucose or sugar level)

In some studies, the periodontal pathogen, P gingivalis was not associated with increased risk of pancreatic cancer, while the presence of A. actinomycetemcomitans did confer additional risk.

Large, prospective cohort studies are required to further validate these findings. Ultimately, the identification of oral microbiota related to cancer development may provide predictive biomarkers for the early detection of pancreatic cancer.


How to detox the liver:

- Water
- Probiotics
- Fiber
- Eat fruits and veggies
- Protein

https://www.deltadentalins.com/oral_health/pancreatic.html
Poor Oral Health and the Heart

Bacteria that cause gum disease are also found to increase cholesterol and inflammation in heart arteries

https://fightgumdisease.com/total-health/heart-disease/

In 2012, experts from the American Heart Association reviewed the available scientific evidence and concluded that poor oral health hasn't been proved to cause heart disease — and that treating existing gum disease hasn't been proven to reduce the risk of heart disease.

Still, studies have shown:
- Poor oral health linked to higher blood pressure, worse blood pressure control

Hypertension Journal Report 2018


Gum disease is linked with blood vessel disease, heart attacks, strokes, Alzheimer’s Disease, and many forms of cancer.

Bones and Joints

- Imbalance between bone loss and bone formation results in decreased bone mineral density.
- Decreased bone density in the jawbone
- Greater alveolar bone resorption
- Increasing the depth
- Increase in the number of gingival pockets
- Invasion by periodontal pathogens

This chronic infection leads to local and systemic increases in interleukin 6, which is a known predictor of bone loss.

As with many of the conditions already discussed, it is impossible to state that periodontal disease directly causes osteoporosis; however, the studies seem to lean toward a positive relationship between the conditions.

Currently there is no strong evidence to suggest that treating periodontal disease will have an impact on osteoporosis

P. gingivalis: best known for causing periodontitis

Periodontal disease is an inflammatory disease that steadily eats away at gums and bone that support teeth, due in part the production of gingipains, powerful enzymes that chop up other proteins.

It contains the enzyme peptidyl-arginine deiminase, which is involved in citrullination.

The bacteria is linked to the chronic inflammatory disease, Rheumatoid arthritis (RA) and Alzheimer’s and other brain diseases.

Brain Diseases

Alzheimer's Parkinson's Dementia Depression

Porphyromonas gingivalis, a bacterium commonly associated with chronic gum disease, is capable of traveling from mouth to brain where it triggers chemical changes that damage cognitive function.

Medical Complications of Obesity

Weight/Obesity
When the researchers introduced P. gingivalis into the mouths of eight mice, they found that the bacteria migrated into all of their brains within a few weeks.
Bidirectional Link

- Hyperglycemia negatively impacts oral health and severe periodontitis can negatively impact glycemic control
- Individuals with diabetes have at least a 3 times greater risk of periodontitis than those without diabetes
- Studies have shown that patients with well-controlled diabetes have no increased risk of periodontitis compared to individuals without diabetes
- Greater amounts of alveolar bone loss, abscess formation, and poor healing
- Local inflammation and a loss of connective tissue
- The prolonged exposure to glycation end products
- Rapid destruction of the PDL
- Crevicular fluid - higher amount of inflammatory mediators

Asthma
COPD
Pneumonia
Diabetes

Mechanical removal of the biofilm + use of oral antibiotics has the greatest impact on glycemic control and periodontal disease in diabetic patients.

Aggressive prevention and treatment of periodontal disease in diabetic patients is an effective way to mitigate the medical complications of this chronic disease.

Oral Health and the Respiratory System

- Bi-Directional Link
- Poor oral health
- 5X more likely to develop asthma
- Nearly 10% of all youth have asthma
- 40% of children have allergies
- Most common chronic disease under the age 18
- Mouth breathing
- Post nasal drip
- Medications to manage symptoms
- Can all lead to dry mouth and inflammation

Causal relationship between periodontitis and chronic obstructive pulmonary disease (COPD)

Bacteria present in the gingival sulcus or the subsequently formed periodontal pockets, may have easy access to the blood vessels.

The microorganisms may also enter the lungs by inhalation, but the most common route of infection is aspiration of oropharyngeal secretions.

Therefore, it is plausible that oral microorganisms might infect the respiratory tract, causing COPD.

- No specific oral pathogens tested
- Vivid peri., gingival, papilla bleeding and plaque index
- More inflamed and bleeding tissues = greater link to COPD and greater tissue loss, more advanced peri.-greater link
- Still need more evidence
- To date - not proven to be causal association

Pneumonia and Respiratory Diseases

*Staphylococcus aureus* and other aerobic organisms (F. Scannapieco, personal communication)

Oral and dental causes of aspiration pneumonia These studies have linked the outcome of aspiration pneumonia with dental decay, periodontal disease, poor hygiene, the need for help feeding, and trouble swallowing

http://oshnewsnetwork.com/2016/04/06/lung-cancer-periodontal-disease-association/?platform=hootsuite

http://academic.oup.com/cid/article/40/12/1807/314357
Obstructive Sleep Apnea
- Systemic inflammation and obesity
- IL, the concept of systemic inflammation was discovered
- Involves the endothelium and other organ systems
- Chronic inflammation is often observed in obesity
- IL6, IL8, TNF, CRP
- Insulin, Blood glucose
- Low grade chronic inflammation is 2-3X increase in systemic concentrations of cytokines, CRP

Crosstalk: Hormones and Oral Health in Women
- Estrogen deficiency leads to upregulation of immune cells
- Oral manifestations of menopause (estrogen receptors in oral mucosa, gingiva, salivary glands):
  - Burning mouth syndrome
  - Lichen planus:
  - Neurological disorders: Trigeminal neuralgia (TN) Post Menopause
  - Eating disorders

Women’s Health
- You may be 11 times more likely to develop breast cancer if you have poor oral health or gum disease.

Malampatti and Throat Score
- Malampatti and Throat Score
- https://dimensionsofdentalhygiene.com/article/Screening-for-Obstructive-Sleep-Apnea/
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4247552/
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3178963/

Menopause
- Estrogen deficiency reduces bone density
- Gingivostomatitis
- Birth control: Synthetic progesterone
- Gums shiny and bleed easily
- Change in taste sensation
- Burning mouth

FEMALE REPRODUCTIVE

Menstruation
- High levels of progesterone cause dilation of blood vessels
- Blocks the repair of collagen
- Birth control: Synthetic progesterone

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3178963/
https://time.com/4891340/inflammation-mouth-breast-cancer/
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3178963/
Porphyromonas gingivalis and adverse pregnancy outcome
Fusobacterium nucleatum infection was found to be the cause of a stillbirth

Bacteria in Umbilical Cord Linked to Preeclampsia

Pre-Term and Low Birth Rate Babies

Men’s Health

Men’s Health

Pre-Reproductive

Inflammation
Restricted blood flow
Alterations with hormones
Prostate
And dysfunction
May lead to:
Infertility and cancer

Link between ED and gum disease is tied to the inflammation of the gums that passes to the other systems throughout the body

ED also had perio

53%
1 out of 4
25%
Link between ED and gum disease is tied to the inflammation of the gums that passes to the other systems throughout the body

Effects on Sperm
Erectile dysfunction
Low sperm count
Low sperm quality
Prostate cancer

Gum Disease Affects More Than Just Your Mouth...

Men with signs of gum disease have higher levels of Prostate-Specific Antigen present in prostate cancer

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5646603/
http://oshnewsnetwork.com/2016/02/01/bacteria-in-umbilical-cord-linked-

Eyes

Increased pressure in your eye, which then damages the optic nerve

Infection and inflammation at the base of your tooth could release inflammatory agents which travel to the eye

Open-angle

Glucoma

Fluid build up in the front of your eye

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4152129/
Genetics

Genetics, lifestyle have a strong impact on biomarkers for inflammation, cancer.

The results of the study show that hereditary factors play a significant role with proteins associated with 16 genes Genetics - 12X more likely to develop periodontal disease

30% of all perio cases may be genetic related

https://www.sciencedaily.com/releases/2014/08/140822083901.htm

OPPORTUNITES

- ANTI-INFLAMMATORY DIET AND LIFESTYLE
- NEW FOOD PYRAMID
- WHO GUIDELINES
- MIND/BODY PRACTICES
- PROBIOTICS
- EXERCISE
- ANTIOXIDANTS
- Sleep
- Tobacco Cessation, Limit alcohol
- Manage weight
- Use supplements, if needed, like probiotics
- Professional dental care
- Manage hormones
- Education, prevention, screenings, early intervention

Foods that cause inflammation

- Try to avoid or limit these foods as much as possible:
  - Refined carbohydrates, such as white bread and pastries
  - Fries and other fried foods
  - Soda and other sugar-sweetened beverages
  - Red meat (burgers, steaks) and processed meat (hot dogs, sausage)
  - Margarine, shortening, and lard
  - Your immune system becomes activated when your body recognizes anything that is foreign—such as an invading microbe, plant pollen, or chemical. This often triggers a process called inflammation. Intermittent bouts of inflammation directed at truly threatening invaders protect your health.

Anti-inflammatory foods

- Bright green and red, orange veggies
- Olive oil
- Green leafy vegetables, such as spinach, kale, and collards
- Nuts like almonds and walnuts
- Fatty fish like salmon, mackerel, tuna, and sardines
- Fruits such as strawberries, blueberries, cherries, and oranges
- Studies have also associated nuts with reduced markers of inflammation and a lower risk of cardiovascular disease and diabetes. Coffee, which contains polyphenols and other anti-inflammatory compounds, may protect against inflammation, as well.

https://www.mdlinx.com/internal-medicine/article/5662
https://www.theguardian.com/lifeandstyle/2018/aug/03/no-alcohol-beer-all-the-flavour-without-the-booze
https://www.mayoclinic.org/diseases-conditions/heart-disease/in-depth/red-wine/art-20048281
https://www.cancer.org/latest-news/is-chocolate-good-for-you.html
https://www.webmd.com/heart-disease/ss/slideshow-foods-bad-heart
https://www.medicalnewstoday.com/articles/320233.php

Anti-inflammatory diet: What to know

Medical News Today, Jan 3, 2020

- Diet choices may help manage/reverse chronic inflammation
- NUTRIENT DENSE PLANT-BASED FOODS
  - Fruits, Veggies, Omega 3, lean protein, healthy fats, spices
  - Eliminate free radicals from body
  - Ward off cancer cells
  - Encourage processed foods, red meat and alcohol
  - Trigger free radicals in body
  - Can trigger tumor growth
  - Can contribute to chronic pain
- DASH DIET, Mediterranean Diet

https://www.medicalnewstoday.com/articles/320233.php

- Chronic Pain
- Chronic Inflammatory Diseases
- Periodontal Disease
- Rheumatoid Arthritis
- IBS
- Crohns
- Asthma
- Psoriasis
- Hashimotos
- Lupus
- Heart Disease, Obesity and Type 2 Diabetes
### Additional Recommendations

- **Nightshades**
- **Gluten**
- **Carbs**
- **Vegetarian?**

### Does sugar cause inflammation in the body?

- **systematic review from 2018** linked consuming more dietary sugar with chronic inflammation.
- People with higher sugar diets have more inflammatory markers in their blood, including a marker called C-reactive protein.
- Sugar stimulates the production of free fatty acids in the liver. When the body digests these free fatty acids, the resulting compounds can trigger inflammatory processes.
- However, a **systematic review** found no difference in inflammation from fructose and glucose.
- Highest risk: high fructose corn syrup.

[https://www.medicalnewstoday.com/articles/326386.php](https://www.medicalnewstoday.com/articles/326386.php)

### Sleep Loss and Inflammation

Sub-clinical shifts in basal inflammatory cytokines:

- Sleep, therefore, clearly responds to challenges to the host and is affected by the activation of our bodily defense mechanisms.
- Sleep is important for other inflammatory homeostatic functions.
- Or the activation of inflammatory systems that fail to resolve completely.
- IL-1beta, IL-6, and TNF-alpha: inflammatory mediators are elevated.
- Increased insulin resistance.
- Increased mortality.
- Elevated circulating inflammatory mediators obezity.

[https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3548567/](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3548567/)

### How Much Sleep Do You Need?

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<thead>
<tr>
<th>Age</th>
<th>8th Hours Sleep Needed Per Night</th>
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<tbody>
<tr>
<td>Toddler</td>
<td>10.00 (24 hr period)</td>
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<tr>
<td>Preschool</td>
<td>10.50 (24 hr period)</td>
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<td>School Age</td>
<td>11.50 (24 hr period)</td>
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<td>Teen</td>
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<td>Adult</td>
<td>7-9 hours per night</td>
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[https://www.cdc.gov/sleep/about_sleep/how_much_sleep.html](https://www.cdc.gov/sleep/about_sleep/how_much_sleep.html)

### EXERCISE

- Exercise fights inflammation.

Professional Care

- Dentists
- Dental Therapists
- Dental Hygienists
- Dental Assistants
- Dental Administrators/Coordinators/Support Staff

- Public Health Focus on Disease Management
- Referral/Collaboration with the medical community

https://www.youtube.com/watch?time_continue=173&v=1IDXhLr0ULU&feature=emb_logo