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# Open Wide: Optimizing Oral Health Through Diet

## TODAY'S AGENDA:

- Introduction & Housekeeping
- Speaker Introduction
- Presentation
- Q&A
- Closing



## WEBINAR PRESENTER:

**Dr. Sara Karlin, DDS**  
Board Certified Pediatric Dentist



## WEBINAR HOST:

**Keith Hine MS, RD**  
VP of Healthcare, Sports & Professional  
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## WEBINAR PRESENTER:

**Ellen Karlin MMSc, RDN, LDN, FADA**  
Nutrition Consultant

# Objectives

- Explore the bi-directional interrelationships between diet and dental health
- Understand how diet quality enhances the health of intraoral soft and hard tissue
- Discuss the evidence-based research surrounding nutrient-dense dietary patterns to prevent oral disease

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# Nutrition and Dental Health

- Inextricable link between eating patterns and overall health of oral cavity
- “The food we eat can be either the safest and most powerful form of medicine or the slowest form of poison.” Ann Wigmore



# Nutrition and Oral Health

- The Academy's website offers guidance regarding healthy eating to promote healthy teeth
  - “Balanced eating plan” and “variety of nutrient-rich foods” are essential for optimal oral health



# Nutrition and Oral Health

- “A bidirectional relationship exists between oral health and diet and nutrition.”

**ADA** American Dental Association®

America's leading advocate for oral health

- “Dietary choices affect oral health as well as general health and well-being. The AAPD has recommended that the optimal way to obtain adequate amounts of vitamins is to consume a healthy and well-balanced diet.” AAPD Oral Health Policy



AMERICA'S PEDIATRIC DENTISTS  
**THE BIG AUTHORITY** on little teeth®

<https://www.ada.org/en/member-center/oral-health-topics/nutrition-and-oral-health>.

American Academy of Pediatric Dentistry. Policy on dietary recommendations for infants, children, and adolescents. The Reference Manual of Pediatric Dentistry. Chicago, Ill.: American Academy of Pediatric Dentistry; 2020:84-6.

# Oral Microbiome (Oral Microflora)

- Contains > 800 species
  - Distinct microbial habitats (teeth, gingiva, tongue, cheek, lip, hard and soft palate)
- Healthy oral microbiome
  - Digestion, homeostasis in oral cavity, resist pathogens, protect teeth from erosion and caries, protect periodontium
- Impacted by
  - Medication, disease, genetics, smoking, oral hygiene, stress, lifestyle, salivary flow rate and diet
- Whole-food, nutrient-dense dietary patterns crucial for healthy oral microbiome

# An Apple A Day...

- Small study by Rubido et al, published in PLOS ONE
  - N= 20 dental students, ages 20-25
  - 10 brushed with manual toothbrush and sterile water for 2 minutes
  - 10 ate a Golden Delicious apple
  - Saliva samples showed that chewing an apple produced “an immediate reduction in salivary bacterial viability similar to that after tooth brushing.”



# Fermented Dairy

- Randomized clinical trial
  - N= 42 adults ages 23-37
  - Yogurt group: fruit yogurt BID for 8 weeks
  - Control group: fruit soy ice cream BID for 8 weeks
- Result
  - Salivary counts for Streptococcus mutans (*S. mutans*) and lactobacilli lower in yogurt group
- Conclusion
  - Yogurt consumption may decrease number of *S. mutans* in dental plaque



# Probiotic Drinks Affect Oral Health

- Parallel-designed non-blinded study
  - N= 50 male and female volunteer students mean age 25 years
  - 25 drank probiotic milk drink for 8 weeks and had better gingival health than control group
    - ↓ in elastase activity and MMP3 in gingival crevicular fluid
- Small prospective study
  - N= 19 participants ages 32-45
  - 10 lean and 9 obese participants drank fermented soy beverage BID for 4 weeks
    - ↑ Bifidobacteria in stool
    - ↑ Veillonellaceae in saliva

Staab B. J Clin Periodontol 2009;36(10):850-856.

Dioletis, E. BMC Nutr 7, 6 (2021).

# Streptococcus Salivarius and Oral Health

- 2017 systematic review
  - S. salivarius K12 “promising results in treatment of halitosis, but data are still deficient. **Further studies** need to be initiated to improve understanding of the association of oral probiotic S. salivarius K12 with... oral cavity health.”
- 2022 study from China looked at S. salivarius C17<sup>T</sup>, taken from the mouth of healthy 5 year old child
  - Assays revealed
    - Anti-adhesive effect against Staphylococcus aureus
    - “Inhibitory activities against various common pathogenic bacteria”
  - “S. salivarius C17<sup>T</sup> is a **potentially** efficacious oropharyngeal probiotic.”

Zupancic K. *Probiotics Antimicrob Proteins*. 2017;9(2):102-110.

Zhang WX. *Letters in Applied Microbiology*. 2022 published online ahead of print

# Oral Infectious Disease of Hard Tissue in Oral Cavity

# Dental Caries in U.S.

- Dental caries: multifactorial oral infection, biofilm-mediated, sugar-driven → demineralized tooth enamel
- One of the most common chronic diseases of childhood in U.S.
- Prevalence
  - 15% of children < 12 years old have untreated caries in primary teeth
  - 18% of children ages 6-11 have tooth decay in permanent teeth
  - 16.6% of adolescents have tooth decay
  - 90% of adults ages 20-64 have tooth decay

Pitts NB. *Nat Rev Dis Primers*. 2017;3:17030. Published 2017 May 25.

<https://www.nidcr.nih.gov/sites/default/files/2021-12/Oral-Health-in-America-Executive-Summary.pdf>.

# Early Childhood Caries (ECC)

- Preventable
- Infectious
- Communicable disease
- Predisposes child to lifetime of poor oral health



# Maternal Obesity and ECC

- Longitudinal study
- Data from the Norwegian Mother and Child Cohort Study
- N= 1348 children, age 0-5
- Association between maternal health and child's caries risk
- Statistically significant risk factors for ECC:
  - Children of obese mothers → 2.3 times higher risk
  - Mom's diet high in fat and/or sugar
  - Low maternal education level



# Cariogenic Process

- Caries-causing microbes in dental plaque
- Cariogenic bacteria: *S. mutans* & lactobacilli
- Salivary amylase breaks down fermentable carbohydrates into oligosaccharides
- Frequent exposure to simple carbohydrates
- Shift in composition of biofilm
- Decrease in salivary pH
- Demineralization
- Tooth decay
- Chronic infection

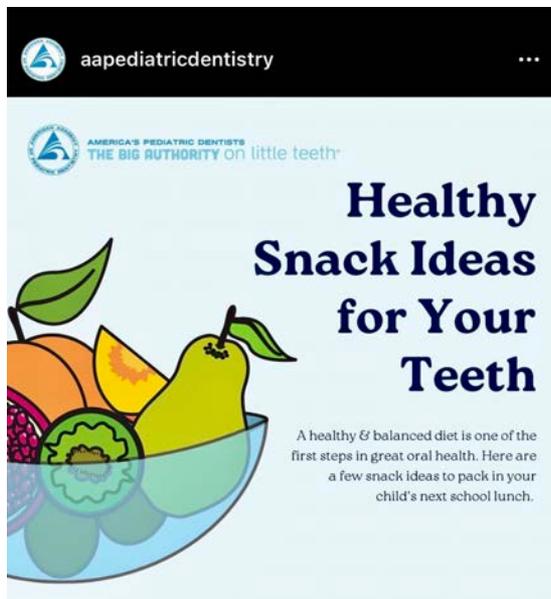
Colak H. *J Nat Sci Biol Med.* 2013;4(1):29-38

<https://www.ncbi.nlm.nih.gov/books/NBK534248/>



# Protective Factors Against Caries

- Healthy dietary patterns
- Tooth brushing
- Flossing



<https://www.mouthhealthy.org/en/nutrition/child-snacking-tips>

# USDA 2020-2025 Dietary Guidelines

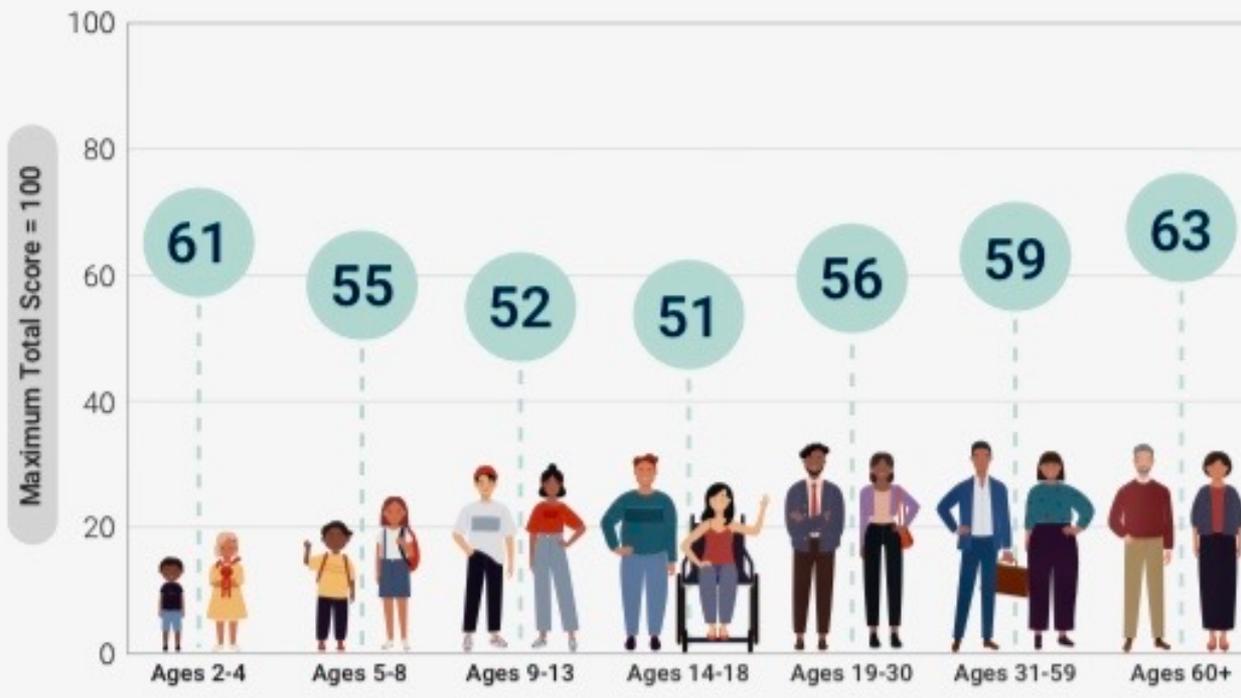
- Evidence-based guidelines for what Americans should be eating
- Make every food choice be a healthy one!
- Nutrients of concern
  - Calcium, potassium, dietary fiber, vitamin D



# Are We Eating Healthy?

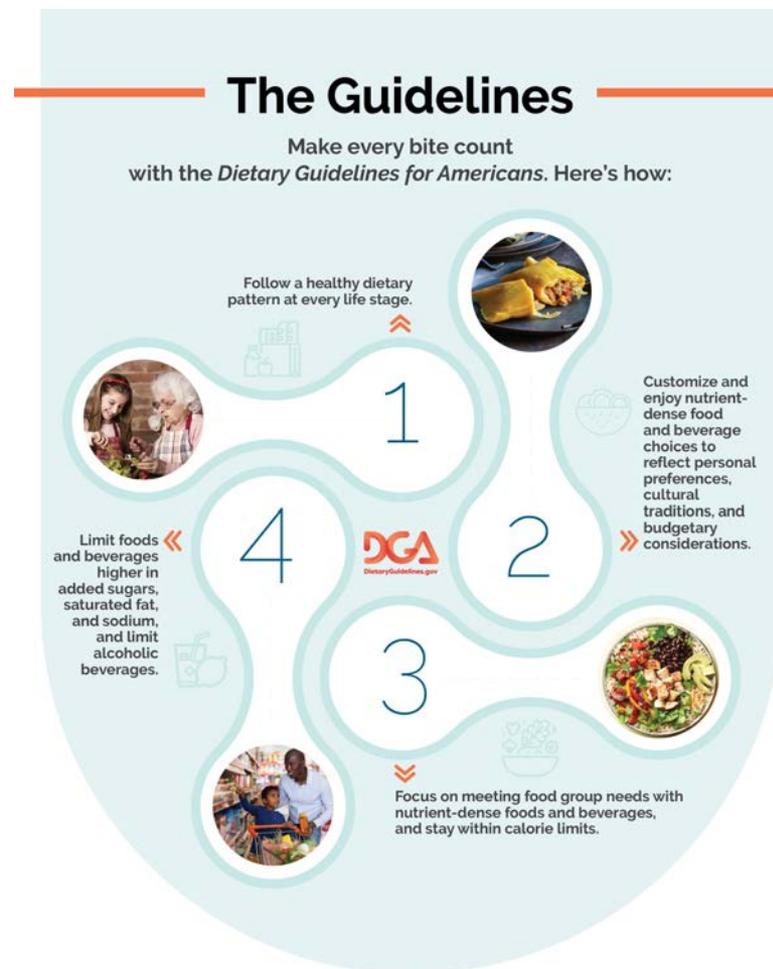
Figure 1-4

## Adherence of the U.S. Population to the *Dietary Guidelines* Across Life Stages, as Measured by Average Total Healthy Eating Index-2015 Scores



# Key Points

- Follow a healthy dietary pattern
  - Healthy U.S.-Style
  - Healthy Vegetarian
  - Healthy Mediterranean-Style
- Close the gap on critical nutrient shortfalls
- Move toward nutrient-dense foods and beverages
  - Limit added sugars to < 10% of total calories



# Why do we care about added sugar?

- May increase risk for
  - Type 2 diabetes, obesity, cardiovascular disease, hypertension, obesity-related cancers, dyslipidemia, non-alcoholic fatty liver disease, **caries**
- Reduce added sugar consumption
  - Promote healthy eating behavior
  - Maintain overall physical and oral health

Paglia L. Eur J Paediatr Dent. 2019;20(2):89, Hu FB Physiol Behav. 2010;100(1):47-54

Vos MB Circulation. 2017;135(19):e1017-e1034, Bray GA Diabetes Care. 2014;37(4):950-956

Freeman CR Front Biosci (Landmark Ed). 2018;23:2255-2266. Published 2018 Jun 1.

# Intrinsic Natural Sugars

- Found naturally in fruits, vegetables, grains and dairy
- Caries protective factors
  - Increase salivary flow
  - Components that support tooth remineralization

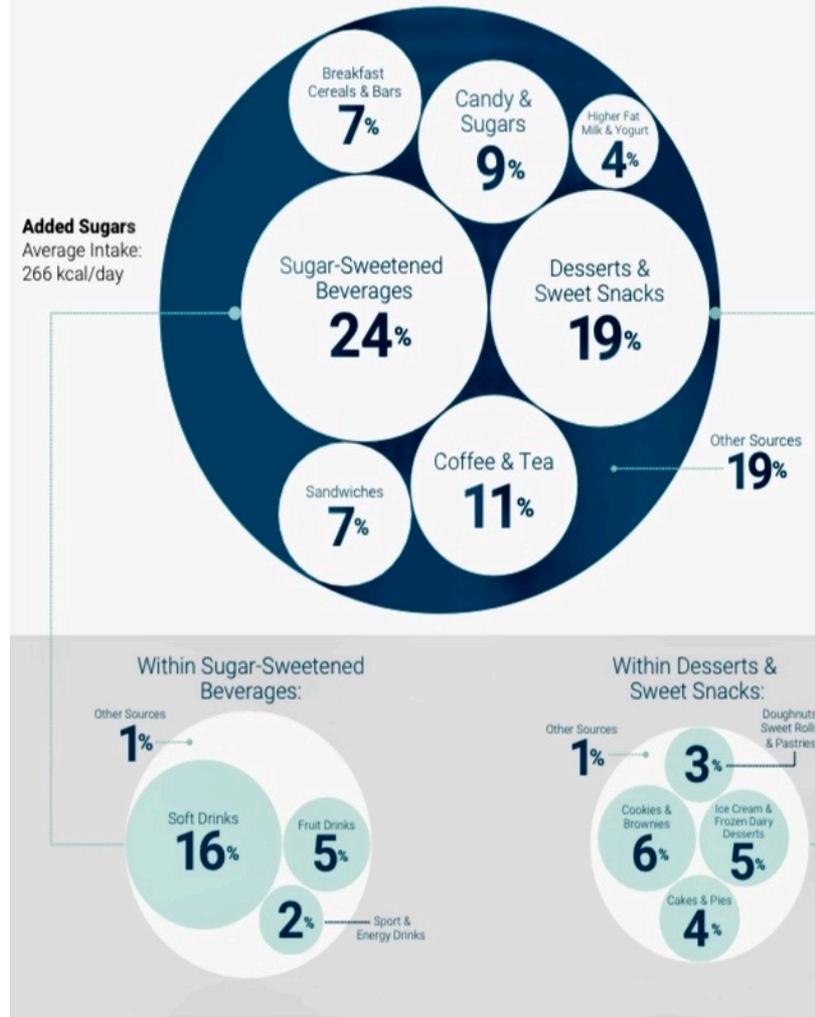


# Added Sugars in Diet

- Brown sugar, table sugar, corn syrup, beet sugar, maple syrup, turbinado sugar, coconut sugar, agave nectar, cassava sugar, molasses, honey, date sugar...

Figure 1-10

## Top Sources and Average Intakes of Added Sugars: U.S. Population Ages 1 and Older



Data Source: Analysis of What We Eat in America, NHANES, 2013-2016, ages 1 and older, 2 days dietary intake data, weighted.

# Sugar Sweetened Beverage (SSB) Intake is Complex

- Cross-sectional study published in Journal of the American Dietetic Association
  - N= 126 children ages 3-7
  - Increased SSB intake was associated with decreased calcium intake in young children
- Recent cross-sectional study in JADA
  - N= 14,192 people, ages 2-74
  - “Independent association b/w SSB consumption and caries...encompassing childhood to old age.”

Keller KL *J Am Diet Assoc.* 2009;109(3): 497-501.

Laniado N *J Am Dent Assoc.* 2020;151(10): 782-789.

Anari R *J Diabetes Metab Disord.* 2019;18(1):7-13.



# Healthy Beverage Guidance

TECHNICAL SCIENTIFIC REPORT

## Healthy Beverage Consumption in Early Childhood

Recommendations from Key National Health  
and Nutrition Organizations

Healthy Eating  
Research

September 2019

## HEALTHY DRINKS. HEALTHY KIDS.

Research shows that what children drink from birth through age five has a big impact on their health – both now and for years to come. While every child is different, the nation's leading health organizations agree that for most kids, the following recommendations can help to set children on a path for healthy growth and development. As always, consult with your health care provider about your child's individual needs.

### ALL KIDS 5 AND UNDER

All kids 5 and under should avoid drinking flavored milks, toddler formulas, plant-based/non-dairy milks\*, caffeinated beverages and sugar- and low-calorie sweetened beverages, as these beverages can be big sources of added sugars in young children's diets and provide no unique nutritional value.

### 0-6 MONTHS



Babies need only **breast milk** or **infant formula** to get enough fluids and proper nutrition.

### 6-12 MONTHS



In addition to **breast milk** or **infant formula**, offer a small amount of drinking **water** once solid foods are introduced to help babies get familiar with the taste – just a few sips at meal times is all it takes. It's best for children under 1 not to drink juice. Even 100% fruit juice offers no nutritional benefits over whole fruit.

### 12-24 MONTHS



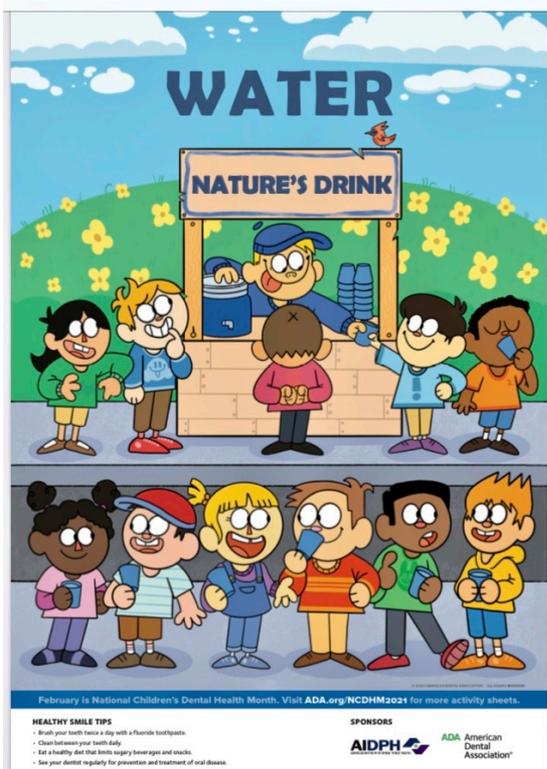
It's time to add **whole milk**, which has many essential nutrients, along with plain drinking **water** for hydration. A small amount of juice is ok, but make sure it's 100% fruit juice to avoid added sugar. Better yet, serve small pieces of real fruit, which are even healthier.

### 2-5 YEARS



**Milk** and **water** are the go-to beverages. Look for milks with less fat than whole milk, like skim (non-fat) or low-fat (1%). If you choose to serve 100% fruit juice, stick to a small amount, and remember adding water can make a little go a long way!

# Fluoridated Water Recommendations



## Establish a Healthy Beverage Pattern

An important part of establishing an overall healthy dietary pattern is careful consideration of beverages. Guidance for different beverage categories is provided below.

## WATER

For healthy infants with adequate intake of human milk or infant formula, supplemental water is typically not needed in the first 6 months. Small amounts (up to 4 to 8 ounces per day) of plain, fluoridated drinking water can be given to infants with the introduction of complementary foods. Plain, fluoridated drinking water intake can slowly be increased after age 1 to meet hydration and fluoride needs.

- Page 61 | Dietary Guidelines for Americans, 2020-2025 | **Chapter 2: Infants and Toddler:**

<https://www.ada.org/en/publications/ada-news/2020/november/national-childrens-dental-health-month-on-tap-in-february>  
[https://www.dietaryguidelines.gov/sites/default/files/202012/Dietary\\_Guidelines\\_for\\_Americans\\_2020-2025.pdf](https://www.dietaryguidelines.gov/sites/default/files/202012/Dietary_Guidelines_for_Americans_2020-2025.pdf)

# Healthy and Sustainable Eating Patterns: Caries Prevention

- Reduce amount and frequency of refined carbohydrates
- Select nutrient-dense cariostatic foods and water
  - Fiber, macronutrients, micronutrients, phytochemicals, positively affect gut and oral microbiota
  - Fresh, whole, crunchy, high fiber foods increase flow of saliva
    - Cleanse, lubricate and moisturize oral cavity
    - Promote buffering and remineralization
    - Provide antimicrobial effect

Hoerler SB. *Decisions in Dentistry*. August 2021;7(8)36-39.

Dodds MW. *J Dent*. 2005;33(3):223-233.

# Oral Infectious Disease of Soft Tissue in Oral Cavity

# Gingivitis

- Inflammation of soft tissue surrounding teeth
- Predisposes patient to periodontal disease
- Symptoms:
  - Red, swollen, tender, bleeding gums
  - Generalized inflammation
- Causes are multifactorial and include:
  - Poor oral hygiene
  - Poor diet



Stamm JW. *J Clin Periodontol.* 1986;13(5):360-366

<https://www.nhs.uk/conditions/gum-disease/symptoms>

# Gingivitis Prevention

- RCT, N= 30 adults
  - Continue current dietary intake/ intervention group
  - Results: reduced gingival inflammation seen intervention group
- “Oral health optimized diet”
  - Omega-3 fatty acids
  - Vitamin C
  - Vitamin D
  - Antioxidants
  - Fiber



# Periodontal Disease in U.S.

- Common in adults ages 45-64
  - 40% are affected
  - 10% have severe periodontitis
- Immune response that leads to systemic inflammation, loss of connective tissue, alveolar bone loss, root exposure and tooth loss if untreated
  - Caused by bacteria *Porphyromonas gingivalis* and lipopolysaccharides, which increase host inflammatory response (C-reactive protein) resulting in osteoclastic activity



# Periodontal Disease & Chronic Conditions

- Associated with:
  - Autoimmune disease
  - High blood pressure
  - Cardiovascular disease
  - Type 2 diabetes
  - Adverse pregnancy outcomes, such as preterm birth, low birth weight babies, preeclampsia
  - Alzheimer's disease
  - Severity of COVID-19 infections

# Nutrient Deficiency and Periodontal Disease

- ↓ protein intake
  - Delayed wound healing of oral soft tissue
  - Decreased antibacterial properties of saliva
- ↓ intakes of vitamins D, K , and calcium
  - Impacts alveolar bone density and tooth structure
- ↓ intakes of vitamins A, C, E, copper, iron, zinc and antioxidants
  - Depressed anti-inflammatory and immune response of oral soft tissue

# Nutrient Deficiency and Periodontal Disease

- Omega-3 fatty acids:  $\alpha$ -Linolenic acid (ALA), Eicosapentaenoic acid (EPA), Docosahexaenoic acid (DHA)
- ↓ intake of EPA & DHA
  - Increase risk for periodontitis
  - Nationally representative cross-sectional study published in the Journal of the American Dietetic Association
    - N= >9,000 adults
    - Results: inverse relationship between high dietary intake of DHA and periodontitis



# Oral Health Concerns: Elderly Population

- Edentulism
  - Irreversible, debilitating, devastating condition
  - Etiology includes socioeconomic factors, poor oral and overall health and low vitamin C intake
  - Untreated caries and periodontal disease lead to tooth loss
- Xerostomia
  - Etiology: medications, radiation to head and neck, Sjögren's syndrome, uncontrolled diabetes, end-stage renal disease
  - Symptoms: cracked and dry lips, decreased taste, difficulty chewing, swallowing and speaking
  - Increases risk for caries and periodontal disease

Al-Rafee MA. *J Family Med Prim Care*. 2020;9(4):1841-1843

<https://www.ncbi.nlm.nih.gov/books/NBK545287/>

Gil-Montoya JA. *Med Oral Patol Oral Cir Bucal*. 2016;21(3):e355-e366. Published 2016 May 1.

# Nutritional Counseling Improves Diet

- Nutrition intervention for edentulism, wound healing, and xerostomia:
  - Mechanical soft or pureed diet
  - Nutritional shakes
  - Protein shakes
  - Adequate fluids
  - Discourage sucking on lemons or lemon candies
  - Referral to dental clinician for evaluation



# Diet and Dietary Patterns

# Nutrient-dense Eating Style Reduces Caries Risk

- Cross-sectional study using data from the National Health and Nutritional Examination Survey (NHANES)
- N= 7,751 adults
- Examined decayed, missing, filled teeth and untreated caries and HEI scores
- Results
  - Higher HEI scores associated with less untreated caries
  - Less sugar, more whole fruits and total fruits, greens and beans were associated with lower caries risk
- “Integration of oral health promotion with nutrition education and guidance is crucial to ensure comprehensive care for patients of all ages.”

# Eating More Plants may Reduce Gingivitis

- Recent German RCT, N= 32 adults
  - Half ate plant-based whole foods for 4 weeks (low in processed food, high in plants) and half maintained current eating habits
  - Results showed significant reduction in gingival bleeding in plant-based whole-foods group
  - “Dental teams should address dietary habits and give adequate recommendations in the treatment of gingivitis, since it might be a side effect of a pre-inflammatory Western diet.”



# Healthy Mediterranean-Style Eating Pattern



# Antioxidants and Oral Health

- Laiola et al. investigated saliva samples
  - N= 49 individuals
  - Randomized into Mediterranean diet group or control group for 8 weeks
  - Results revealed reduced levels of oral pathogens in salivary microbiota of Mediterranean diet group
- Antibacterial activity of antioxidants on oral microbiome
  - Theaflavins in tea inhibit *P. gingivalis*
  - Catechins and ellagic acids found in fruits and vegetables inhibit *Prevotella intermedia*
  - Polyphenols in pomegranate juice may inhibit biofilm formation
  - Polyphenols in cranberries may interfere with *P. gingivalis* activity
  - Vitamins C, E and A help maintain periodontal homeostasis

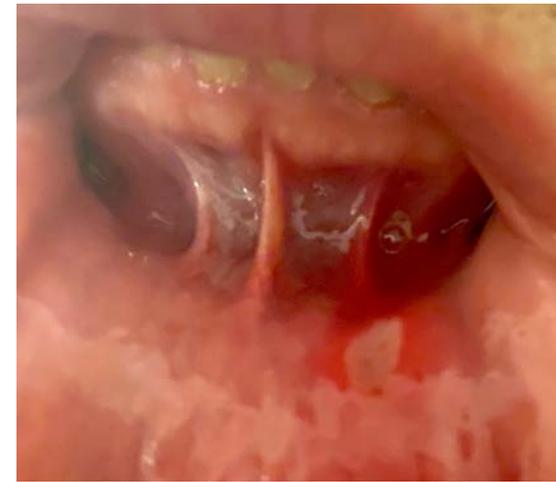
# Plants and Periodontitis

- Systematic review of 15 studies by Skoczek-Rubinska et. al.
  - 4 intervention studies, 3 cohort studies, 8 cross-sectional studies
  - N= 10,604 people ages 15-90
  - Concluded that incorporating at least 5 servings of fruits and vegetables a day may help to prevent the progression of periodontal disease and tooth loss



# Complex Multifactorial Oral Conditions

- Require interprofessional approach
  - Caries
  - Enamel erosion
  - Oral pain following dental procedure
  - Multiple missing teeth
  - Gingivitis
  - Severe periodontal disease
  - Xerostomia
  - Difficulty chewing
  - Recurrent aphthous ulcers
  - Poorly controlled diabetes



# Key Takeaways

- Clinical Setting, Community and Research
  - Include oral health screening in nutrition assessment
  - Look for potential oral manifestations of systemic disease
  - Evaluate potential impaired nutrient intake
  - Collaborate with dental teams to provide comprehensive oral health and nutrition programs in community
  - Integrate oral and nutrition initiatives into employee wellness programs
  - Incorporate oral health into nutrition research

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