

Food for Thought: Dental and Nutrition Collaborative



NDAND 2022 Nutrition Symposium

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

Outline

- Synergistic relationship between nutrition and oral health
- Oral disease
 - Dental caries
 - Gingivitis
 - Periodontitis
- Food synergy
- Evidence-based research supporting the association between whole-food dietary patterns and oral health
- RD intervention for oral health promotion and disease prevention

Nutrition and Oral Health

- “Nutrition is an integral component of oral health. Collaboration between dietetics and dental professionals is recommended for oral health promotion and disease prevention and intervention.”¹



Nutrition and Oral Health

- “A bidirectional relationship exists between oral health and diet and nutrition.” ²

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 ³



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

Oral Health is Essential for Overall Health

Oral Health in America



Dental and other health care professionals must work together to provide integrated oral...health care...

Good oral health is important for the overall health and well-being of individuals of all ages...

Oral health services are evolving rapidly towards interprofessional models of delivery that integrate services across the health professions...⁴

Synergistic Relationship: Nutrition and Oral Health

- “The food we eat can be either the safest and most powerful form of medicine or the slowest form of poison.” -Ann Wigmore
- Dental health and healthy eating patterns are inextricably linked
- Nutrient-dense eating styles play an integral role in the overall health of the hard and soft tissues in the oral cavity



Oral Infectious Disease of Teeth

- Dental caries is one of the most common chronic diseases of childhood in U.S. and globally ⁴
- Scope of the problem
 - 15% of children < 12 years old have untreated caries in primary (baby) teeth
 - 18% of children ages 6-11 years old have tooth decay in permanent teeth
 - 1 in 6 adolescents and 9 out of 10 adults ages 20-64 have tooth decay ⁴

Early Childhood Caries is Preventable

- Infectious, communicable disease, predisposes child to lifetime of poor health
 - Chronic dental pain
 - Inflammation
 - Infection to bone and soft tissue
 - Premature tooth loss
 - Huge economic burden
 - Significantly lower quality of life for both child and parent
 - **Difficulty chewing; impacts nutrient intake**
 - Delayed physical development
 - Poor self image
 - Poor academic performance ⁵
- Significant intervention



Severe Caries and Malnutrition

- Recent cross-sectional study published in the International Journal of Environmental Research and Public Health
 - N=273 Nepali children ages 6 months-12 years
 - Traditional diet in Nepal- rice, lentils, vegetables (Dahl Bhat); traditional snacks- corn, popped corn, roasted soybeans, foods made from locally grown wheat and millet
- Children in Nepal are currently consuming “sweets, processed snacks, sugar-sweetened tea, other sugar sweetened beverages (SSBs) on a daily basis...have become a daily staple of the diet for many children”
- Increased intake of sugar consumption was associated with both severe cavities and childhood malnutrition
 - Malnutrition (WHO criteria) was seen
 - 20% of children had stunted growth, 14% underweight, 6% wasted
- “Association between severe caries and malnutrition underscores the importance of caries prevention and early intervention” for optimal oral health, optimal nutritional status, optimal growth and development. ⁶

Cariogenic process

- Salivary amylase breaks down fermentable carbohydrates into oligosaccharides
- Oral microbiome includes caries-causing microbes that live in biofilm (dental plaque)
- Cariogenic bacteria (Streptococci mutans & Lactobacillus) + sugar → lactic acid
- Shift in composition of biofilm, decrease in salivary pH → oral infection
- As oral infection progresses, teeth become weak, demineralized → calcium and phosphate ions are taken from tooth
- Result → tooth decay
- Untreated → chronic infection
- **Frequency of eating simple carbohydrates and duration of exposure increases caries risk** ^{5,7}



Factors that Protect Against Caries

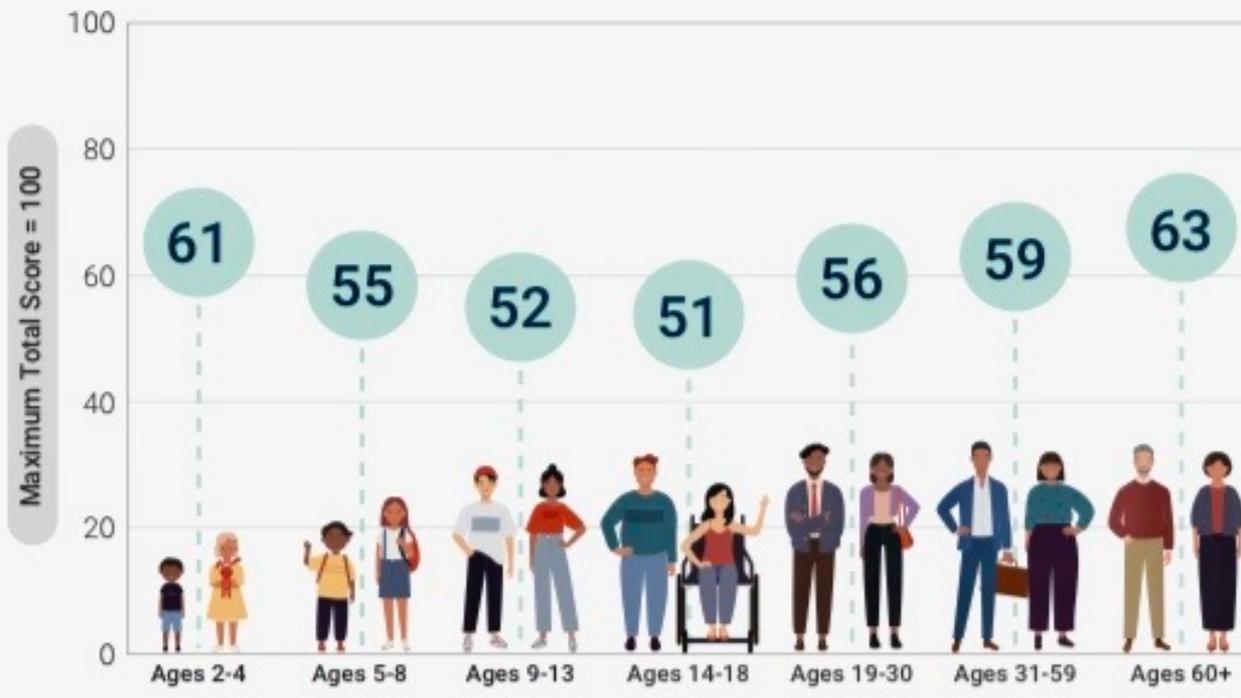
- **Healthy dietary patterns** for entire family
 - Avoid snacks that contain simple sugars and are sticky or slow dissolving
 - Eat simple carbs with a meal
 - Eat fruits, vegetables, cheese, yogurt, peanut butter or whole grain snacks
 - Do not eat or drink after brushing teeth at night
- **Saliva** acts as a buffering agent, the pH rises and enamel re-mineralized
- **Tooth brushing** twice a day for 2 minutes, always before bed
- Begin **flossing** once 2 teeth touch
- **Fluoridated water** ⁸



Are We Eating Healthy? ⁹

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



USDA 2020-2025 Dietary Guidelines

- Evidence-based guidelines for what Americans should be eating
- Make every food choice be a healthy one!
- Move toward toward more whole, nutrient-dense, high-quality foods
- Move away from ultra-processed, highly refined foods; specifically limiting added sugars



The Guidelines

Make every bite count
with the *Dietary Guidelines for Americans*. Here's how:



Why do we care about Added Sugar?

- DGA tells us to limit added sugars to < 10% of total calories
- Increases risk for obesity, cardiovascular disease, hypertension, obesity-related cancers, dyslipidemia, fatty liver disease and **dental caries** ^{10, 11, 12, 13}
- Reducing added sugar consumption may help to promote healthy eating behavior and maintain overall physical and behavioral health. Future research in the form of RCTs is needed in humans to fully understand the systems-wide effects of sugar ¹⁴



Photo by Suzy Hazelwood from Pexels

Intrinsic Natural Sugars

- Found naturally in fruits, vegetables, whole grains and dairy
- May be protective against caries
 - Fiber
 - Fluid
 - Polyphenols
 - Calcium
 - Potassium
 - Vitamin D
 - Vitamin C

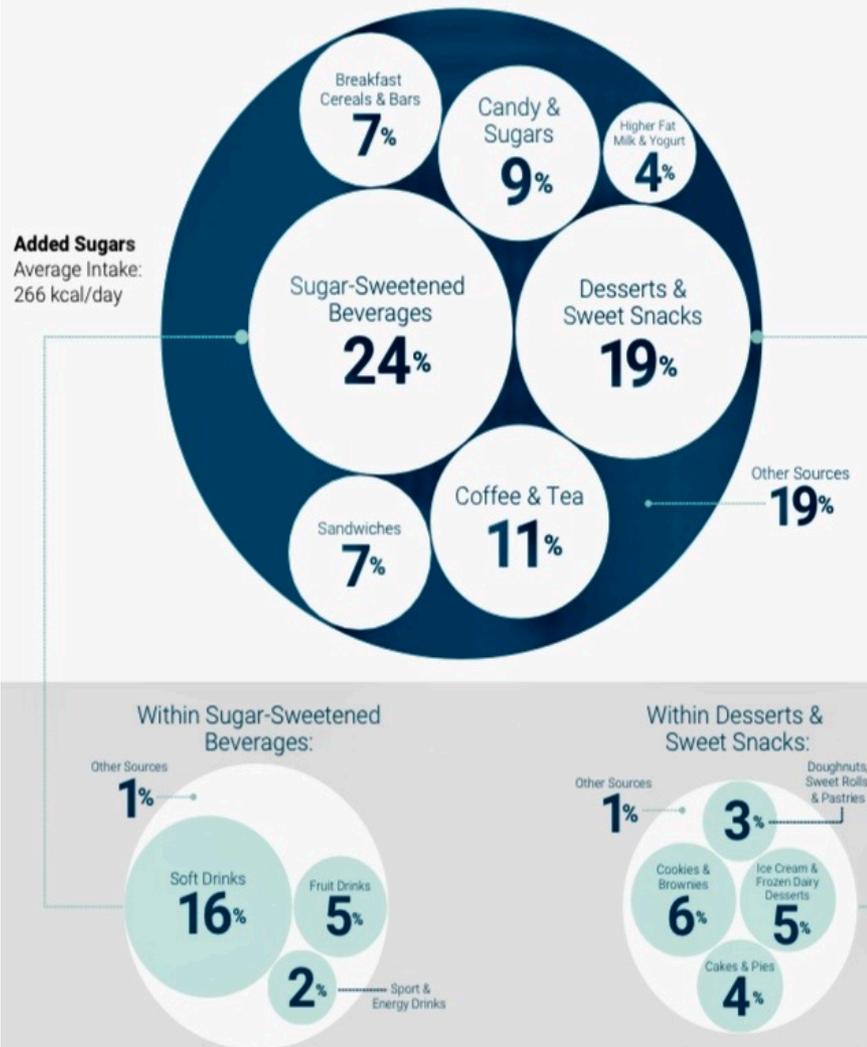


Added Sugars in Diet

- 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 Beverages (SSB)

- Cross-sectional study published in Journal of the American Dietetic Association, found that increased SSB intake was associated with decreased calcium intake in young children ¹⁵
- Recent cross-sectional study in JADA looked at > 14,000 people, ages 2-74 “independent association b/w SSB consumption and caries...encompassing childhood to old age.” ¹⁶



Parents' Ability to Identify Sugar in Beverages

- April, 2021 cross-sectional study of U.S. parents of children age 1-5, published in *Pediatric Obesity* revealed that parents are not able to recognize added sugars and/or non-nutritive sweeteners in beverages
- Assess parents' ability to identify sugar and non-nutritive sweeteners in beverages commonly consumed by children
 - Viewed both front and back of beverage labels
 - Incorrect identification of beverages with non-nutritive sweeteners
 - Parents' misconceptions:
 - Unsweetened juice contained added sugar
 - Sweetened flavored water did not contain sugar
 - 100% fruit juice contained < 100% juice ¹⁷

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

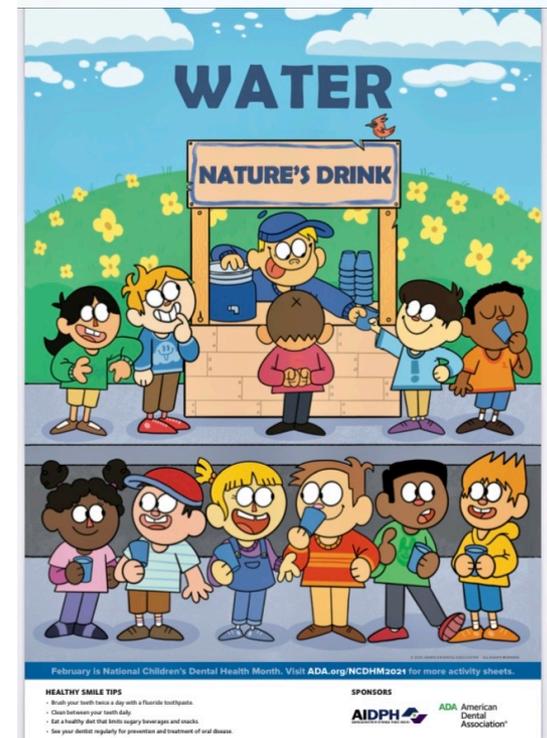


It's time to add **whole milk**, which has many essential nutrients, along with plain drinking **water** for hydration. A small amount of juice is ok, but make sure it's 100% fruit juice to avoid added sugar. Better yet, serve small pieces of real fruit, which are even healthier.

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!



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.

Research: Maternal Obesity and Child's Caries Risk

- Wigen et al conducted a study based on data from the Norwegian Mother and Child Cohort Study
- Children at high risk of developing caries at age 5
 - Children of obese mothers → 2.3 times higher risk of caries development
 - When mom consumed more sugar or fat than recommended, child had 1.5 and 1.6 times higher risk
 - Other factors that increased caries risk included non-western origin and low education ¹⁹

Nutrition-based Approach to Preventing Caries

- Promote healthy eating patterns, behaviors and habits
 - Frequency of food and beverages > 2 hours apart
 - Discourage frequent snacking
 - Discourage sips of juice all day
 - Discourage cariogenic foods and SSBs
- Encourage nutrient-dense whole grains, fruits, vegetables, lean proteins, nuts, seeds, dairy
 - Contain fiber, vitamins, polyphenols, minerals, antioxidants, positively affect gut and oral microbiota and are associated with reduced caries risk
 - Fresh, whole, crunchy high fiber foods, cheese, herbs and spices can help increase flow of saliva which protects oral cavity

Oral Disease of Soft Tissue

- Marginal gingivitis can begin in early childhood ²⁰
- Inflammation of the soft tissue component of the periodontium
- Initial condition that predisposes patient to periodontal disease
- Symptoms:
 - Red, swollen, tender, bleeding gums ²¹
 - Note the generalized inflammation here
- Reversible



Gingivitis

- Poor oral hygiene and poor diet contribute to development of gingivitis
 - SSBs
 - Sweets
 - Simple carbohydrates
- RCT (small pilot study) - healthy eating patterns after 4 weeks resulted in reduced gingival inflammation
 - Omega-3 fatty acids
 - Vitamin C
 - Vitamin D
 - Antioxidants
 - Fiber ²²



Periodontal Disease

- Periodontal disease affects 90% of the world's population ²³
- 2 in 5 adults ages 45-64 in U.S. have periodontitis, 1 in 10 have severe periodontitis ⁴
- Affects the tissues that surround and support teeth
- Leads to systemic inflammation, loss of connective tissue, bone support and teeth, if left untreated ²³
 - Caused by bacteria - Porphyromonas gingivalis and lipopolysaccharides, which increases host inflammatory response (C-reactive protein) resulting in osteoclastic activity
 - Note the root exposure and tissue loss here:



Periodontal Disease

- Periodontal disease is an inflammatory disease associated with:
 - High blood pressure ²⁴
 - Cardiovascular disease ²⁵
 - Diabetes ^{26, 27, 28}
 - Adverse pregnancy outcomes, such as preterm birth, low birth weight babies, preeclampsia ^{29, 30, 31}
 - Alzheimer's disease ³²
 - Severity of COVID-19 infections
 - Case-control study published in Journal of Clinical Periodontology, n = 568 patients found that periodontitis was associated with COVID-19 complications and death ³³

Omega-3 Fatty Acids

- α -Linolenic acid (ALA) , Eicosapentaenoic acid (EPA) , Docosahexaenoic acid (DHA)
 - Supports brain, eye and cardiovascular health
 - Protective against periodontitis
 - Anti-inflammatory and antibacterial effect on common oral pathogens ^{34, 35}
 - Inverse relationship between high dietary intake of DHA and periodontitis
 - Nationally representative cross-sectional study published in the Journal of the American Dietetic Association, n = >9,000 adults showed an inverse relationship between high dietary intake of DHA and periodontitis ³⁶



Compromised Dentition

- 13% of adults in U.S. ages 65-74 are edentulous ⁴
- Cross-sectional survey of 753 adults ages 65+ published in Public Health Nutrition
 - >50% of edentulous adults
 - Unable to eat nuts, apples, raw carrots
 - Lower serum levels of beta-carotene, folate and vitamin C
 - Plasma vitamin C was significantly associated with # of teeth and posterior contacting pairs of teeth
 - Study findings: # and distribution of natural teeth in older adults affects both nutrient intakes and biochemical measures of nutritional status ³⁷

Dentures and Bite Force

- Recent cross-sectional study published in International Journal of Environmental Research and Public Health
- N = 240 elderly patients
- Dental intervention
 - removable partial dentures
 - fixed prosthesis
 - implant-supported rehabilitation
- Findings showed patients with removable partial dentures are at increased risk for poor nutrient intake
 - Reduction in chewing force
 - Consuming softer foods, low in nutrient-density and higher in calories
- “Appropriate masticatory function is needed to maintain a correct nutritional plan...” ³⁸

Oral Microbiome

- Healthy oral microbiome is necessary for digesting food, maintaining homeostasis in the oral cavity, resisting pathogens, protecting teeth from erosion and caries, protecting our periodontium
- Impacted by medication, disease, genetics, smoking, oral hygiene, stress, lifestyle, salivary flow rate and diet
- Whole-food, nutrient-dense dietary patterns help maintain a balanced oral microbiome consistent with oral health

An Apple A Day...

- Small study by Rubido et al was published in PLOS ONE
 - N = 20 dental students, ages 20-25
 - 10 brushed with a 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.”³⁹



Fermented Dairy

- Randomized clinical trial by Petti et al
 - N = 42 adults ages 23-37
 - Yogurt group ate fruit yogurt twice daily for 8 weeks
 - Control group ate fruit soy ice cream twice daily for 8 weeks
- Results showed salivary counts for *S. mutans* and lactobacilli were lower in the yogurt group
- Suggests that yogurt consumption may help to decrease the number of cariogenic bacteria in dental plaque ⁴⁰



Probiotic Drinks Affect Oral Health

- Study published in J Clin Periodontol (2009) ⁴¹
 - N = 50 male and female students mean age 25 years
 - 25 drank a probiotic milk drink for 8 weeks and had better gingival health than control group
- Small prospective study published in BMC Nutrition (2021)
 - N = 19 participants ages 32-45
 - 10 lean and 9 obese participants drank a fermented soy beverage twice a day for 4 weeks
 - Changes were seen in both the oral and gut microbiomes; increase in Veillonellaceae in saliva
 - Potentially beneficial changes were seen in both the oral (saliva) and gut (stool) microbiomes ⁴²

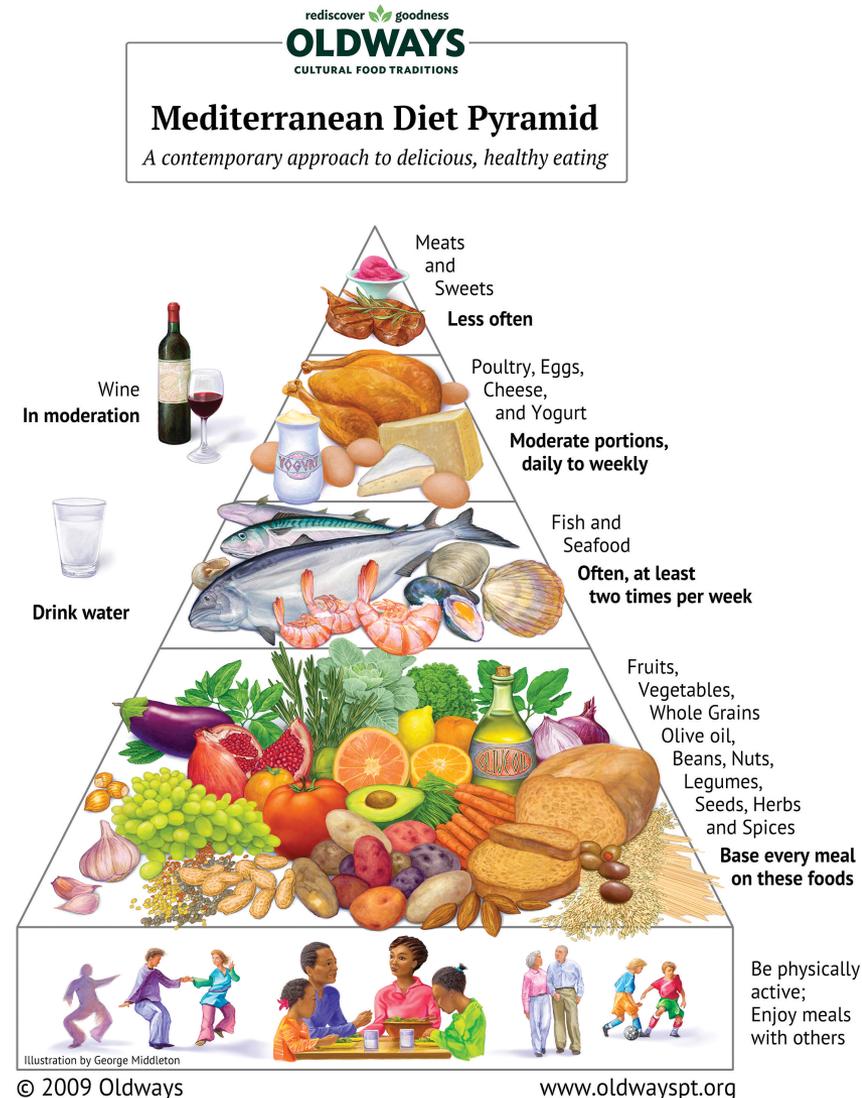
Food Synergy

- “In recent years researchers, public health experts and RDs have acknowledged that nutrients and foods are not consumed in isolation. Rather, people consume them in various combinations over time-a dietary pattern-and these foods and beverages act synergistically to affect health.”⁹



Food Synergy in Mediterranean Diet 43

- Recent study by Laiola
- N = 49 overweight and obese individuals
- ½ ate a Med diet for 8 weeks
- Reduced levels of oral pathogens were found in salivary microbiota of Med diet group⁴⁴



Nutrient-dense Eating Style Reduces Caries Risk

- Recent cross-sectional study
- 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
 - Food synergy: 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.”⁴⁵



Food Synergy may Reduce Gingivitis

- A recent German study
 - Randomized controlled trial
 - N = 32 adults
 - Half ate plant-based whole foods for 4 weeks (low in processed food, high in plants) and half no change to 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.”⁴⁶



Plants and Periodontitis

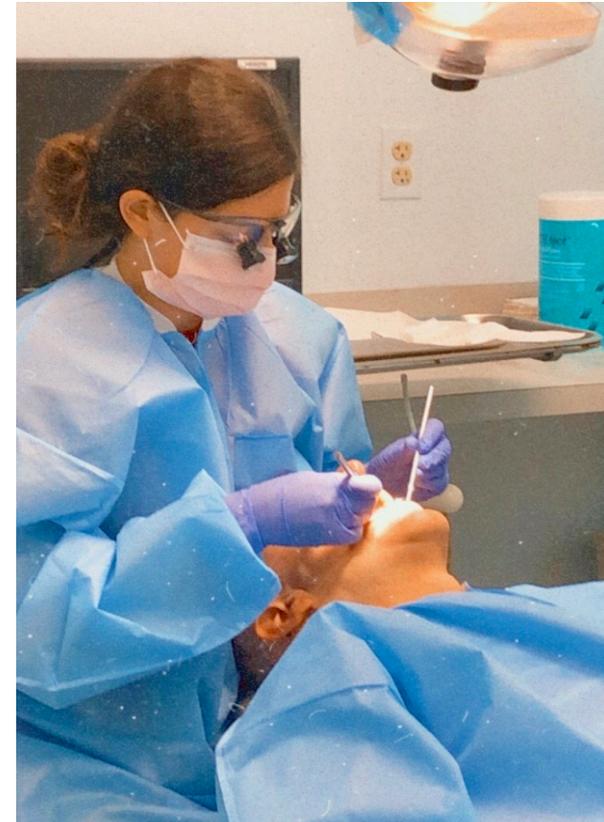
- Polyphenols in cranberries-proanthocyanidins may interfere with *P. gingivalis* activity ⁴⁷
- Systematic review of 15 studies by Skoczek-Rubinska et al
 - 4 intervention studies, 3 cohort studies, 8 cross-sectional studies
 - N = 10,604 people ages 15-90
 - Systematic review concluded that incorporating at least 5 servings of fruits and vegetables a day may help to prevent the progression of periodontal disease and tooth loss ⁴⁸



Nutrition-focused Assessment of Oral Health

- **Call to action:** RDs in Clinical Setting, Community and Research

- Work closely with dental team to assess oral-nutrition issues and treatment plans
 - Caries
 - Enamel erosion
 - Oral pain following dental procedure
 - Multiple missing teeth
 - Gingivitis
 - Severe periodontal disease
 - Xerostomia
 - Difficulty chewing
 - Recurrent aphthous ulcers
 - Complex medical patients



Thank you



karlinellen@gmail.com

