Definitions

• **Nutrition:** The science of food, the nutrients and other substances therein, their action, interaction and balance in relation to health and disease and the processes by which the organism ingests, digests, absorbs, transports, utilizes and excretes food substances.

• **Diet:** The regimen of food and drink intake that support nutrition.

Definitions (con’t)

• **Recommended Dietary Allowance (RDA):**
  Lists the amounts of nutrients needed daily by most normal persons to carry on maintenance, growth, and repair of the body, plus an extra margin of safety for individual variation.

• **Reference Daily Intake (RDI):**
  Provides a legal standard (based on RDA) for food processors to label the nutritive content of their products.

Definitions (con’t)

• **USDA Daily Food Guide (mypyramid.gov):**
  Established the Basic Four Food Groups (1957); now includes a food pyramid categorizing foods by similarity in composition or nutritive value or both; has the potential to provide individualized dietary recommendations.

Role of Nutrition in Dental Health

• **Nutritional Deficiencies**
  **Pediatric Patients**
  Chronic malnutrition
  Vitamin D
  **Adult Patients**
  Vitamin B
  Iron
Dental Caries

Dental caries is an infectious, communicable disease resulting in destruction of tooth structure by acid-forming bacteria found in dental plaque, an intraoral biofilm, in the presence of sugar...and which can be remineralized.

IN ORDER FOR A PERSON TO GET DENTAL CARIES, THE PERSON MUST BE INFECTED WITH DENTAL CARIES CAUSING BACTERIA. WITHOUT THESE BACTERIA IN ONE’S MOUTH THE PERSON...

CANNOT GET DENTAL CARIES

The Caries Evolution

Histopathology of Caries

Remineralization is possible as long as enamel surface is intact

Remineralization is accelerated if there is sufficient ambient fluoride

Keyes Dental Caries Diagram

- And TIME
Plaque/Bacteria

- Mutans Streptococci
  - Strep mutans
  - Strep sobrinus
- Lactobacilli

Acquisition of MS by Infants - “Classic” Data

- MS colonize oral cavity after eruption of teeth – require hard, non-desquamating surface
- Window of infectivity relies on virgin tooth surfaces for initial colonization
- Second window may open when permanent dentition erupts

Transmission of MS

- Transmission may be direct or indirect

Acquisition of MS by Infants

- MS is poor competitor for colonization – once stable biofilm is in place, ability for MS to colonize is reduced

<table>
<thead>
<tr>
<th>Birth</th>
<th>mitis</th>
<th>sanguis</th>
<th>25%</th>
<th>mutans</th>
<th>75%</th>
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<tr>
<td>1</td>
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Stephan Curves

Infants who acquire sanguis early may have less MS. Those who acquire MS early may be at higher risk for caries.
### Host Factors

<table>
<thead>
<tr>
<th>Genetic Influences</th>
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<tbody>
<tr>
<td>Tooth Anatomy</td>
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<tr>
<td>Arch Shape</td>
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<tr>
<td>Salivary Composition</td>
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<td>Resting pH</td>
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<tr>
<th>Behavioral Influences</th>
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<tr>
<td>Eating Patterns</td>
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<tr>
<td>Food Choices</td>
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<tr>
<td>Oral Self-Care Practices</td>
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<td>Health Care Beliefs</td>
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### Host Factors

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<thead>
<tr>
<th>Increased Susceptibility for Children</th>
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<tr>
<td>Low SES</td>
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<tr>
<td>Mother with active caries</td>
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<tr>
<td>Siblings with active caries</td>
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<tr>
<td>Personal past experience with caries</td>
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### Host Factors

<table>
<thead>
<tr>
<th>Decreased Susceptibility to Caries for Children</th>
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</thead>
<tbody>
<tr>
<td>Access to Care</td>
</tr>
<tr>
<td>Parental assistance with oral health</td>
</tr>
<tr>
<td>Behaviors conducive to health</td>
</tr>
</tbody>
</table>

### Saliva

- Provides Moisture
- Cleansing Properties
- Buffers Acid
- Calcium/Phosphate Aid in Remineralization

*Low Salivary Flow = Increased Susceptibility*

### Food Factors

<table>
<thead>
<tr>
<th>A Concern for Smooth Surface Caries</th>
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<tr>
<td>Use Sealants for Pit/Fissure Surface Risk</td>
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### Food Factors

<table>
<thead>
<tr>
<th>Increased Susceptibility</th>
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<tr>
<td>Fermentable Carbohydrates</td>
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<tr>
<td>Sugars</td>
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<td>Sugar/Starch Combination</td>
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<table>
<thead>
<tr>
<th>Decreased Susceptibility</th>
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<tr>
<td>Proteins</td>
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<tr>
<td>Fats: Cheese, Nuts</td>
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<tr>
<td>Foods with Sugar Alcohols</td>
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<tr>
<td>“Healthy” Snacks</td>
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</tbody>
</table>
Role of Diet in Dental Caries

- **Main Concerns**
  - Type of Food
    - Supports Caries Process vs. No Support
  - Frequency of Ingestion
  - When Ingested

Etiology - Diet

- Hopewood House (Australia) 1952-56
  - diets devoid of sugar and white flour
  - extremely low dental caries prevalence
- Vipeholm (Sweden) 1945-52
  - effects of frequency of sugar consumption
  - effects of consistency (retentiveness) of sugar
  - sugar at meals vs. in between meals

Lessons from Vipeholm

- *Sugar consumption at meals* – slight increase in caries
- *Sugar between meals* – marked increase in caries
- *Sugar in sticky candies* – greatest caries activity
- Caries activity differs among individuals
- Caries activity declines with withdrawal of sugar-rich foods

Fermentable Carbohydrates

- Sucrose (most acid producing)
- Glucose
- Fructose
- Maltose
- Lactose
- Starch (least acid producing)

Sucrose

- Glucose + fructose

Glucan

- Water Extracellular “glue”
- Enables adhesion to tooth
  - reduced susceptibility to mechanical disruption
- Inhibits diffusion properties of plaque
  - reduces buffering capacity of saliva
  - inhibits transport of acid away from tooth soluble
Plaque pH after Sucrose Ingestion

Role of Refined Starch
- Soluble starch and refined starch can be broken down by salivary amylase into sugars
- These refined carbohydrates cause a variable pH drop that may be as large as that caused by sucrose

Foods Containing Sugar: Examples
- Retentive
  - Pastries, Cookies
  - Sugar-Coated Cereals
  - Dried Fruits
  - Jams, Jellies
  - Crackers, Potato chips
- Non-Retentive
  - Soda Pop
  - Fruit Juices
  - Chocolate Milk
  - Milk Shakes, Malts
  - Popsicles

Healthy Choices: Examples
- Protective
  - Nuts
  - Cheese
  - Meat
  - Eggs
- Defensive
  - Popcorn
  - Pizza
  - Tacos
  - Salads
  - Fresh Vegetables
  - Unsweetened Juices
  - Unsweetened Cereals

Caries Prevention: Dietary Counseling
- Identification of Primary Contributor
- 24-Hour Food Recall
- 3 or 5-Day Food Diary

Common Dietary Risk Factors
- Infants
  - Bottle use at night with juice/milk after tooth eruption (most common juice=apple)
  - On-demand Breastfeeding after age 12 months
  - Liquid Oral Medications
- Toddlers
  - Sippy Cup Use (milk, pop, juice between meals)
  - Sugared Cereals
  - Liquid Oral Medications
Common Dietary Risk Factors

- Adolescents/Adults
  Soda pop, coffee syrups and sweeteners
- Seniors
  - Sweets, frequency of eating
  - Ingestion of liquids, candies, or mints that provide moisture

Highly Cariogenic If Consumed Frequently

- Hard Candies
- Breath Mints
- Soda Pop

Dietary Trends and Caries

- Ingestion of Pre-prepared Foods
- Eating Out
- Eating Often

4 grams = 1 teaspoon
42 grams = 10.5 teaspoons of sugar

Nutrition Facts

- Total Fat: 2.5g
- Saturated Fat: 1.5g
- Cholesterol: 10mg
- Sodium: 120mg
- Total Carbohydrate: 44g
- Dietary Fiber: 4g
- Sugar: 6g
- Protein: 0g
- Vitamin A: 21%
- Vitamin C: 2%
- Calcium: 30%
- Iron: 6%

Dietary Trends and Obesity

- Pre-prepared Meals
- Eating Out
- Eating Often
- Lack of Knowledge of Serving Size
Supersize Me!

Dental Caries Process: 
Food Factors

• Almost everything we eat can be used by S. mutans to create acid
• Exceptions: protein (meat, fish, soy), cheese, nuts, eggs, vegetables, and fat
• Hidden sugars are everywhere!

United States: The Revis family of North Carolina
Food expenditure for one week $341.98

Italy: The Manzo family of Sicily
Food expenditure for one week: 214.36 Euros or $260.11

Poland: The Sobczynscy family of Konstancin-Jeziorna
Food expenditure for one week: 582.48 Zlotys or $151.27
Mexico: The Casales family of Cuernavaca
Food expenditure for one week: 1,862.78 Mexican Pesos or $189.09

Ecuador: The Ayme family of Tingo
Food expenditure for one week: $31.55

Chad: The Aboubakar family of Breidjing Camp
Food expenditure for one week: 685 CFA Francs or $1.23

Dietary Recommendations:
Minimize the Risk
- Limit snacks to less than three a day
- For improved dental health and to reduce the risk of diabetes and obesity, limit sugar consumption and portion size
- Include treats with a meal rather than separately; avoid juices at bedtime
- Brush, swish or chew after eating
- Include a splurge day now and then (Saturday Sweets Day)

SUGAR SUBSTITUTES
- Have low potential for caries production (FDA, 1996)
- Some can maintain cariogenic bacteria however acid production does not occur with typical use
- Examples: sorbitol, mannitol, aspartame, sucralose
- Some are considered cariostatic (Xylitol)

XYLITOL
- Sugar alcohol made from plant material
- Major benefits compared to other sugar alcohols
  - Cannot be metabolized by Mutans Streptococci
  - Over time, bacterial flora becomes less cariogenic
  - Is the only sugar alcohol with the same sweetness as sucrose
Organizational Support

- National Institutes of Health (NIH)
- US Army: “Look for Xylitol First”
- Xylitol in army rations
- Federal Drug Administration (FDA)

Xylitol Content of Products: Examples

- Gum
  - Epic 1 gm per piece
  - CareFree Koolerz 1.5 gm per piece
  - Spry/Omnii .7 gm per piece
- Mints
  - Epic/Spry/Omnii .5 gm per piece
    (2 mints/serving)

Xylitol Products

- Insufficient research available at this time to recommend:
  - Mouthrinses
  - Nasal Sprays
  - Gels
  - Syrups
  - Towelettes
  - Vitamins

Examples

- Food Products
  - Energy bars (Buddha Bars) 4-5g/bar
  - Kraft Jell-O Pudding sugar free 7g/serving
- Oral Hygiene Products
  - Biotene Toothpaste 10%
  - Epic Toothpaste 35%
  - Crest Cool Mint 10%
XYLITOL

- Must be used a minimum of 3 times daily to be effective; 6-10 gm per day
- Must be maintained in the mouth for 5 minutes
- 100% xylitol products are most effective
- Products that list xylitol as one of the first three ingredients usually provide 1 gram per serving

Xylitol: Concerns

- Osmotic diarrhea, if consumed in large quantities
- Prevention:
  - Start with a small dose (1-2 grams daily) and eventually work up to the recommended dose (6 grams minimum)

Best Xylitol Product Resource

- Conference Paper: Xylitol, Sweeteners and Dental Caries
  - Kiet Ly, MD, Peter Milgrom, DDS and Marilyn Rothen BS, RDH
  - J Pediatric Dentistry 28: 2, 2006

Other Remineralizing Agents

- CPP-ACP (Recaldent)
  - Not Discussed today:
    - ACP
    - Novamin
    - Sensistat

RECALDENT

Active Ingredients:
- calcium and phosphate ions
- encased in casein (milk protein) forming CPP-ACP (Casein Phosphopeptides-Amorphous Calcium Phosphate)
- released over time (substantivity)

How it works:
- enhances the role of fluoride
- stimulates salivary flow
- helps reduces dentinal hypersensitivity

RECALDENT Research Findings

- “The addition of recaldent to either sorbitol or xylitol-based gums produced a significant increase in enamel remineralization relative to the sugar-free gum not containing recaldent.”
  - Biological Therapies in Dentistry, 2002
Trident with Recaldent

- Gum and Mints
- Proven to remineralize early lesions
- Contains Calcium/Phosphate
- Derived from lactose-free milk
- Contraindicated for patients with true milk allergies

Recaldent Products

A Huge Societal Problem

Soft Drinks: A Definition

- A beverage made by absorbing carbon dioxide into water, and has fruit or other flavors such as cola

Soft Drink Consumption

- Accounts for 27% of beverages consumed
- Spent $54 billion to purchase 14 billion gallons
- 19 oz / person / day

Soft Drink Marketing

- Four major companies spent 631 million dollars on advertising
- Nearly 450 different soft drinks on the market
Intake By Age

- 6-11 year olds
  50% consume average of 15 oz/day

US Dept of Agriculture
Food Consumption Surveys

Intake during Teenage Years

- 13-18 y.o. boys
  - 25% > 2 cans per day
  - 5% > 5 cans per day
- 13-18 y.o. girls
  - 25% > 2 cans per day
  - 5% > 3 cans per day

Health and Nutritional Impact

- National surveys indicate calcium intake of
  children (teens in particular) are below
  recommended levels (may lead to increased risk
  for osteoporosis)
- Association with poor diet and obesity
  - Obesity has been suggested as possible
    origins of several diseases of adulthood:
    osteoporosis, heart disease, diabetes, and
    cancer (Jacobson, 1999; Brody, 1999)

Intake during Teenage Years

10% of total caloric intake comes from
soft drinks!

Soft Drink Intake Negatively Correlates with:

- Calcium
- Magnesium
- Vitamin A
- Vitamin C

Two Main Concerns

1.) Almost all soft drinks are fruit-based or
    carbonated or both, and may be acidic enough
    to damage (erode) dental tissues
2.) Those which contain fermentable
    carbohydrates (i.e. sugars), increase the risk for
    dental caries
Lower the pH the more acidic the beverage

<table>
<thead>
<tr>
<th>Drink</th>
<th>pH</th>
<th>Drink</th>
<th>pH</th>
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<tbody>
<tr>
<td>10% Sucrose</td>
<td>7.00</td>
<td>Nestea</td>
<td>3.04</td>
</tr>
<tr>
<td>Diet 7-Up</td>
<td>3.67</td>
<td>Gatorade</td>
<td>2.97</td>
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<tr>
<td>Diet Dr. Pepper</td>
<td>3.41</td>
<td>Dr. Pepper</td>
<td>2.92</td>
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<tr>
<td>Diet Coke</td>
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<td>2.80</td>
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<tr>
<td>7-Up</td>
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<tr>
<td>Diet Pepsi</td>
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Beverage Facts

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<tr>
<th>Beverage Type</th>
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<th>Energy</th>
<th>Carbohydrates</th>
<th>Protein</th>
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<td>Gatorade</td>
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<td>160</td>
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<td>8</td>
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Mouth Acid Levels

![Mouth Acid Levels Graph]

Minimize the Risk

- Drink carbonated soft drinks and sweetened liquids (like fruit juice) in moderation
- Never consume soft drinks or juice at bedtime (liquid pools in your mouth and coats the tongue and teeth for hours)
- Read Labels – sweetened beverages are high in sugar

Generalized Cervical Decalcification and Dental Caries - A Difficult Restorative Challenge!

Minimize the Risk

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Methamphetamine
America’s Most Dangerous Drug

The rampant caries associated with methamphetamine use is attributed to the following: the acidic nature of the drug, the drug’s xerostomic effect, its propensity to cause cravings for high calorie carbonated beverages, tooth grinding and clenching and its long duration of action leading to extended periods of poor oral hygiene.

www.ada.org
Role of the Dental Professional

- Identify Caries Status
  - Free
  - Active
  - At-risk/Prone: low, medium, high
  - Inactive
- Restore Active Lesions
- Develop a plan to prevent future dental caries

Preventive Measures

- Fluoride
- Sealants
- Dental Dietary Counseling
- Oral Hygiene Instruction
- Antimicrobial Therapy
- Xylitol

Dental Dietary Counseling

- Primary Factor
- 24-hour Food Recall
- 5-day Food Diary
- Identify Problem: Food, Frequency, Adequacy
- Suggest Substitutes/Life Style Changes
- Refer to a Registered Dietitian

Referral

- Recommended for patients with special diets, unusual eating habits, unusual lifestyle circumstances, or unexpected changes in weight
- Registered Dietitian
  - Healthwise Mayo C228; 612-672-6700 or 612-672-4849