Learning Objectives

- Describe the role of water in health
- Identify the signs and symptoms of dehydration
- List risks and consequences of dehydration
- Apply ideas for achieving daily fluid intake to promote hydration

Background

- Average adult body is 50-60% water
  - Muscle ~65-75%
  - Body fat ~20%
  - Plasma ~90%
  - Cells ~60-80%
- 10% water loss can cause significant health problems
- 20% water loss could lead to death

Water is an Essential Nutrient

- $\text{H}_2\text{O}$ = Most abundant compound in the human body
- Water is involved in all biochemical reactions
  - Fills cellular spaces
  - Solvent for vitamins, minerals, amino acids, glucose...
  - Plays key role in digestion, absorption, transportation and use of nutrients
  - Helps with elimination of toxins and waste
- No life exists without water

Calculating Baseline Fluid Needs

- Estimating* fluid requirements in pediatrics:
  - 1 to 10 kilogram (kg) child
    - 100 milliliters (mL)/kg body weight
  - 11 to 20 kg child
    - 1000 mL + 50 mL/kg body weight for each kg >10 kg
  - >20 kg child
    - 1500 mL + 20 mL/kg body weight for each kg >20 kg

*Holliday-Vogel Formula
Calculating Baseline Fluid Needs

• 25 mL older adults; 30 mL middle age; 30-35 mL Healthy/younger adults*

Multiply actual body weight in kilograms (kg) x 25-35 mL

(2.2 lbs = 1 kg)

Example: 150 lb. individual

150 lb. divided by 2.2 lb/kg = 68.2 kg

68.2 kg x 30 mL = 2,046 mL

2,046 mL divided by 237 mL/cup = ~8.6 cups

*AND Nutrition Care Manual

Other Methodology:

• Minimum ~1500 mL

• ~ 6 to 8 cups / day

• 1 mL for every calorie consumed

• 300 mL for first 10 kg (actual wgt) + 50 mL for next 10kg + 15 mL for each additional kg

• 3.7 L fluid/day (~3.0 liters from beverages and the remainder from food) for men and 2.7 L/day (~2.0 liter from beverages) for women

Special Circumstances - Obese

• Use actual body weight

• Equations will result in a range of results

Example: Middle age female weighing 228 lbs. (104 kg)

• 3,120 mL (50 mL)

• 2,000 mL (mL/kcal; assumes 2,000 kcal/day)

• 2,760 mL (equation)

• 2,700 (2,000 from beverages) [DRI]

Range is 2,000 mL to 3,120 mL (8.4 cups to 13 cups)

• Clinical judgement!

Special Circumstances - Elderly

• Body composition changes with aging

• Health, Rx, Diet

• Lower sense of thirst

• Toileting concerns

• Mobility, access

Special Circumstances - Athletes

• Performance / Serious Athletes

• Pre-event: 2 cups 2 hours prior

• At start: 6-8 oz. [178-237mL]

• During: 8 oz. [237mL] every 10-15 minutes

• Events longer than 60 minutes require an electrolyte beverage

• Post-event: 16 oz. [474mL] for every pound [2.2 kg] lost during the event

*Cold water is the preferred beverage in extreme temperature, humidity, time use a ‘Gatorade’ type beverage to replenish CHO and electrolytes

Special Circumstances – Health

Increased Need 30-35mL/kg

• Constipation / Diarrhea / Emesis

• Fever

• Fistulas / draining wounds / Hemorrhage

• Hot/dry environment

• Rx [diuretics]; Use of air-fluidized mattress

• Dehydration

CHF / COPD

Edema

Hepatic failure (ascites)

Renal Failure

Third spacing of fluid

Significant HTN
Remember..... We “eat” water too

• ~20% of daily fluid come from foods
• Water content 90% or greater:
  • Broccoli, cucumber, iceberg lettuce, spinach, radish, carrots, melons, strawberries, cauliflower, tomato, green pepper
  And the list goes on.....

Over Hydration

• Water intoxication is rare
  • Results in hyponatremia
• Two Paths:
  • Excess intake...kidneys cannot keep up with removal
  • Water retention...resulting from conditions where body cannot
  • Excess fluid
  Progressive symptoms: N/V, headache, confusion
  • Hyponatremia: muscle weakness, spasms, cramps, seizures, unconsciousness, coma

Balancing Intake & Output

Defining Dehydration

<table>
<thead>
<tr>
<th>Isotonic</th>
<th>Hypertonic</th>
<th>Hypotonic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of water = loss of sodium</td>
<td>Water loss &gt; sodium loss</td>
<td>Sodium loss &gt; water loss</td>
</tr>
<tr>
<td>Occurs: fasting, vomiting, diarrhea</td>
<td>Occurs: fever, water loss through skin and lungs</td>
<td>Occurs: excess diuretics that cause sodium loss</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Deficiency</th>
<th>Level</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmolality, serum</td>
<td>WNL</td>
<td>&gt; Normal</td>
</tr>
<tr>
<td>Sodium, serum</td>
<td>WNL</td>
<td>&gt; Normal</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>WNL</td>
<td>&gt; Normal</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>&gt; Normal</td>
<td>&gt; Normal</td>
</tr>
<tr>
<td>Albumin, serum</td>
<td>&gt; Normal</td>
<td>&gt; Normal</td>
</tr>
<tr>
<td>BUN</td>
<td>&gt; Normal</td>
<td>&gt; Normal</td>
</tr>
<tr>
<td>Urine Specific Gravity</td>
<td>&gt; Normal</td>
<td>&gt; Normal</td>
</tr>
</tbody>
</table>

Dehydration Risk

• Mild = 2-4% of body’s fluid lost (~3-6 lbs. in a 150 lb. person)
• Moderate = 5% of body’s fluids lost
• Severe = >10% fluid lost & this is life threatening

What happens?

• Hypovolemic shock (physical collapse) can occur
  • Skin is pale, cool & clammy; heart beat is rapid & breathing shallow
  • Blood pressure drops low (may not be measurable)
  • Anxiety, restlessness & thirst increase
  • At temperature of 107°F damages brain & vital organs

Did You Know?

• At the point someone is thirsty they are already dehydrated
• Adults >60 years who only drink when thirsty only drink about 90% of their fluid needs
• If urine is dark yellow / Amber colored person is probably dehydrated!

Garcia ME Dehydration of elderly in nursing homes.  Nutrition Noteworthy 2001; Vol. 4 Issue 1

Monitor for dehydration Risk

- Reduced fluid intake
  - Excess urine
  - Take medicines
  - Recipes / fluid choice
- Health Conditions
  - Diseases of adrenal glands, which regulate the body's water balance
  - Diabetics
  - Eating disorders
  - Kidney disease
  - Chronic lung disease
  - Traumatic brain injury

Monitor for Dehydration

- Increased need due to:
  - Mouth breathers
  - Exercise
  - High climate / room temperatures
  - High altitudes
  - Low humidity
  - High fiber diets
  - Increased fluid losses (caffeine, alcohol consumption)

Caffeine??

- Evidence indicates that consuming up to six mg of caffeine per kg of body weight per day does not impact hydration status of healthy adults.

<table>
<thead>
<tr>
<th>Beverage</th>
<th>Caffeine mg/oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cola, Diet</td>
<td>39 mg / 12 oz</td>
</tr>
<tr>
<td>Cola, Regular</td>
<td>29 mg / 12 oz</td>
</tr>
<tr>
<td>Non-Cola Soda, Diet / Reg</td>
<td>55 mg / 12 oz</td>
</tr>
<tr>
<td>Coffee (brewed)</td>
<td>143 mg / 12 oz</td>
</tr>
<tr>
<td>Tea (brewed)</td>
<td>75 mg / 12 oz</td>
</tr>
</tbody>
</table>

Monitor for Dehydration

- Why are the elderly so challenging?
  - Sense of thirst diminishes with age
  - Bladder control issues
  - Needing assistance to toilet
  - Needing assistance to feed self (also w/ Alzheimer's, dementia, babies & small children)
  - Depression –→ reduced intake
  - Tube fed without adequate water flushes
  - Dysphagia

Dysphagia & Dehydration

- Well accepted among HCPs that a dx of dysphagia triggers concern about nutritional health
- Prevalence individuals >60 yrs (Cichero)
  - 16% hospital setting
  - 26-33% LTC
  - 17.5% of dysphagic pts were dehydrated as compared to 10.8% of non-dysphagic (Whelan)

Dysphagia added 1.15 – 1.64 days to LOS

Dysphagia & Dehydration

- Study with acute stroke pts found, on av., those with dysphagia met only 59% of daily fluid target (Philip and Greenwood)

- Fluid delivery to individuals consuming thickened liquids was 48% lower than those getting regular liquids
  - On average, only 51% of those liquids was consumed
**recognize the signs**

- How do you recognize the problem before it is?
  - Dizziness upon sitting/standing
  - Decreased urine output... UTI, diagnosed renal disease
  - Constipation
    - Usually defined as less than 3 stools per week
  - Confusion; change in mental status
  - Poor skin turgor, dry mucous membranes
  - Fever
  - Skin breakdown or delays in wound healing

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**Lab Screening for Hydration Status**

<table>
<thead>
<tr>
<th>Lab Test</th>
<th>Normal Values</th>
<th>Dehydration</th>
<th>Over-hydration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Osmolality</td>
<td>280-303 mOsm/kg</td>
<td>&gt;305 mOsm/kg</td>
<td>&gt;280 mOsm/kg</td>
</tr>
<tr>
<td>Serum sodium</td>
<td>135-145 mEq/L</td>
<td>&gt;145 mEq/L</td>
<td>&lt;130 mEq/L</td>
</tr>
<tr>
<td>Albumin</td>
<td>3.4 - 5.4 g/dL</td>
<td>Higher than normal</td>
<td>Lower than normal</td>
</tr>
<tr>
<td>Blood urea nitrogen (BUN)</td>
<td>10-20 mg/dL</td>
<td>&gt;35 mg/dL</td>
<td>&lt;7 mg/dL</td>
</tr>
<tr>
<td>BUN/creatinine ratio</td>
<td>10:1</td>
<td>&gt;25:1</td>
<td>&lt;10:1</td>
</tr>
<tr>
<td>Urine specific gravity</td>
<td>1.002-1.028 g/mL</td>
<td>&gt;1.028 g/mL</td>
<td>&lt;1.002 g/mL</td>
</tr>
</tbody>
</table>

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**Medications* Associated with Dehydration/Dry Mouth**

- Albuterol sulfate
- Allopurinol
- Atropine
- Aminophylline HCI (Elixer®)
- Biperidone HCI
- Bupropion HCl
- Chlorpromazine HCI
- Codeine
- Doxapine HCI
- Duraflam* patch
- Haloperidol
- Ibuprofen
- Levofulvin
- Loperamide
- Metoprolol HCl
- Metaxalone (Santan®)
- Oxyphenbutazone (Zigmeen®)
- Phenobarbital
- Phentermine HCI
- Pipamperone
- Tramadol HCl (Ultram®)

*Not an all-inclusive listing

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**Consequences of Dehydration**

- Decreased functional abilities including cognitive status
- Predisposition to falls
- Fecal impaction
- Predisposition to infection
- Fluid and electrolyte imbalance
- Death

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**Death by Dehydration**

- In the absence of food and fluids any person no matter their health will die.
  - **Metabolic events**
    - Urine becomes highly concentrated leading to a burning of the bladder
    - Lining of the stomach dries out
    - Dry heaves and constipation
    - Body temp goes high
    - Skin becomes dry and cracked
    - Respiratory tract would dry out and secretions could plug lungs causing death
    - Within 5 days to 3 weeks major organs would give out and death would occur

Source: Brophy, New England Sinai Hosp. Published on 6/22/2007 @ www.cnsnews.com
Hydration ↔ Dehydration

- **Prevention of Dehydration**
  - Identify individuals at risk
  - Train staff to recognize signs/symptoms
  - Keep treatment team informed
  - Encourage fluids
  - Involve people in their beverage choice/plans
  - Offer variety—both hot and cold

- **Treatment of Dehydration:**
  - Address the underlying cause
  - Mild dehydration can be corrected in 24-48 hours

Improving Hydration Daily

- High risk patients/residents should be singled out for observation and special attention
- Schedule fluid at specific times each day.
  - At meals, between meals and at medication pass
  - Adequate staff available to assist with meals

Improving Daily Hydration

- Beverages should be offered at social occasions such as activities, therapy and informal gatherings

  - Offer a wide variety of beverages
    - Consider the individual’s preferences

Improving meal Hydration

- Gelatin, soup, puddings, custards, ice cream, sherbet, supplements and yogurt are good sources of fluid
- Have a system to report observations and warning signs to nursing or dietary
  - Record fluid intake and output

Improving Daily Hydration

- Encourage patient / resident to drink every time you see them
- Make sure pitcher and cup are near enough and light enough for the patient / resident to lift and drink
  - Offer the appropriate assistance as needed
- Post signs to help remind [all] people to drink and refresh themselves

Summary

- Water an essential nutrient
- Fluid needs are individualized
- Communicate the need
- Implement care plan
- Monitor and Evaluate
- Reassess and make changes as needed
- Improve hydration daily
Thank you for participating in today’s session!

This program is intended to provide general information about hydration but is not intended to provide medical advice.

Presentation Author: Debra Zwiefelhofer, RDN, LD

Your Special Diet Partner

POST TEST

• Calculate your daily fluid requirement and make a plan for your personal hydration!