INE INSTITUTE OF NUTRITIONAL ENDOCRINOLOGY

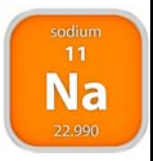
Micronutrients: Sodium

Dr. Ritamarie Loscalzo

Medical Disclaimer: The information in this presentation is not intended to replace a one-on-one relationship with a qualified health care professional and is not intended as medical advice. It is intended as a sharing of knowledge and information from the research and experience of Dr. Ritamarie Loscalzo, drritamarie.com, and the experts who have contributed. We encourage you to make your own health care decisions based upon your research and in partnership with a qualified health care professional. This presentation is provided for informational purposes only and no guarantees, promises, representations or warranties of any kind regarding specific or general benefits, have been or will be made by Dr. Ritamarie Loscalzo, her affiliates or their officers, principals, representatives, agents or employees. Dr. Ritamarie Loscalzo is not responsible for, and shall have no liability for any success or failure, acts and/or omissions, the appropriateness of the participant's decisions, or the use of or reliance on this information.

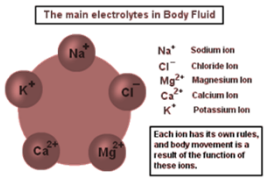
Sodium General Info

- ✓ Essential macro mineral
- ✓ An electrolyte
- ✓ Contributes to maintenance of concentration and charge differences across cell membranes
- ✓ Most abundant cation in body (93%)
- ✓ It has a single charge as opposed to the two electrical charges on most of the other minerals
- ✓ As a result, it is less tenacious in its hold on other structures and tends to move readily through solutions, especially water



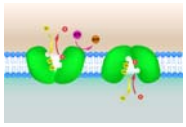
Sodium as an Electrolyte

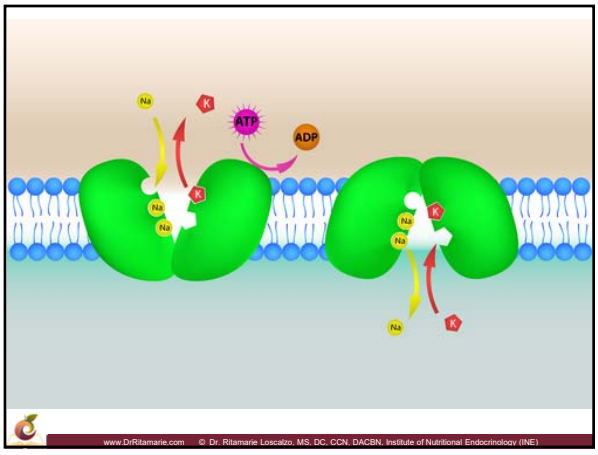
- ✓Sodium is a cation
- ✓An electrolyte is a salt or ion that is electrically-charged and moves to either a **negative (cathode)** or **positive (anode) electrode**:
- ✓Ions that move to the cathode (**cations**) are positively charged
- ✓Ions that move to the anode (**anions**) are negatively charged



Sodium and Cell Membrane Potential

- ✓ Maintains cell's membrane potential via the sodium, potassium-ATPase pumps
  - ➢ Pump sodium out of the cell
  - ➢ Pump potassium in
- ✓ Activity accounts for 20% - 40% of the resting energy expenditure in a typical adult
- ✓ Tight control of cell membrane potential is critical for
  - ➢ Nerve impulse transmission
  - ➢ Muscle contraction
  - ➢ Cardiac function
  - ➢ Stomach function
  - ➢ Nerve function



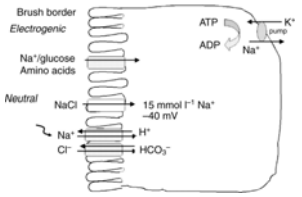


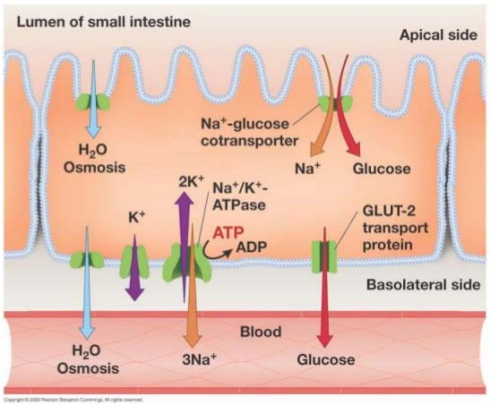
Sodium Functions

- ✓ Maintains proper water balance
- ✓ Maintains blood pH
- ✓ Involved in acid-base balance
- ✓ Main cation of extracellular fluid
- ✓ Needed by organs (including liver, spleen, and brain)
- ✓ Needed by synovial membranes of joints, cartilage, and ligaments
- ✓ Useful in neutralizing acidic byproducts (lactic, butyric, acetic, and fatty acids) when saturated fats or meats are metabolized

Sodium Absorption

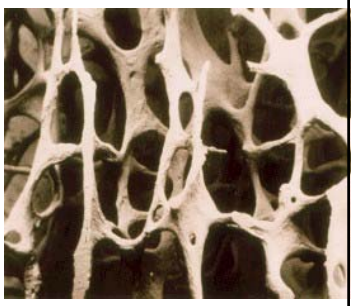
- ✓ 95% to 100% absorbed, remainder excreted in feces
- ✓ 3 major absorption pathways in intestine
  - **Na^+ – Glucose cotransport system:** Throughout small intestine – involves a carrier in brush border
  - **Electroneutral Na^+ and Cl^- cotransport system:** Small intestine and proximal large intestine
  - **Electrogenic sodium transport system:** Mainly large intestine





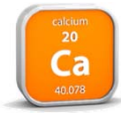
Sodium Storage

- ✓ About 30% stored on surface of bone crystals
- ✓ Remainder is in extracellular fluid, nerve, and muscle tissue



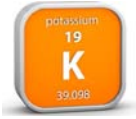
Sodium Interactions

- ✓ **Calcium:** Excess sodium can deplete calcium; increases urinary loss
- ✓ **Potassium:** Excess sodium increases potassium excretion; excess potassium increases sodium excretion



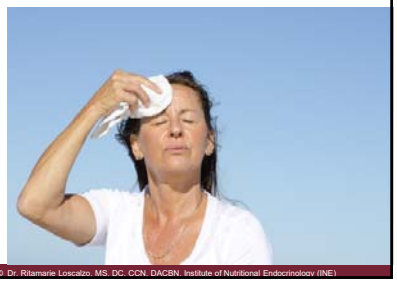
The Sodium-Potassium Balance

- ✓ Potassium concentration higher on the inside of the cell; sodium higher on the outside
- ✓ Delicate sodium-potassium balance is vital for good cellular health
- ✓ Integrity of cell's internal charges must remain in equilibrium with its external charges
- ✓ Balance can not be maintained if excessive sodium is ingested without simultaneously increasing potassium levels



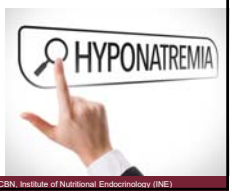
Causes of Sodium Deficiency

- ✓Extensive sweating
- ✓Prolonged endurance exercises
- ✓Vomiting
- ✓Diuretics
- ✓Excess ADH (Anti-diuretic hormone)



Impact of Sodium Deficiency

- ✓ Abdominal cramps
- ✓ Anorexia
- ✓ Confusion
- ✓ Dehydration
- ✓ Depression
- ✓ Dizziness
- ✓ Low blood pressure
- ✓ Memory impairment
- ✓ Muscular weakness
- ✓ Flatulence
- ✓ Hallucinations
- ✓ Heart palpitations
- ✓ Impaired sense of taste
- ✓ Nausea and vomiting
- ✓ Poor coordination
- ✓ Recurrent infections
- ✓ Headache
- ✓ Fatigue
- ✓ Lethargy
- ✓ Seizures
- ✓ Weight loss

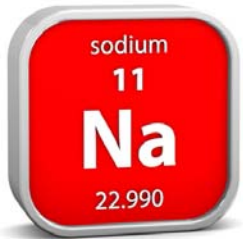


Adequate Intake of Sodium

Life Stage	Age	Males and Females Sodium (g/day)	Salt (g/day)
Infants	0-6 months	0.12	0.30
Infants	7-12 months	0.37	0.93
Children	1-3 years	1.0	2.5
Children	4-8 years	1.2	3.0
Children	9-13 years	1.5	3.8
Adolescents	14-18 years	1.5	3.8
Adults	19-50 years	1.5	3.8
Adults	51-70 years	1.3	3.3
Adults	71 years and older	1.2	3.0
Pregnancy	14-50 years	1.5	3.8
Breast-feeding	14-50 years	1.5	3.8

Sodium Maximum Recommendations

- ✓ No more than 2.3 g or 2,300 mg daily for healthy adults (1 tsp)
- ✓ According to the Institute of Medicine, the maximum daily intake for sodium are the following:
  - ➢ Ages 1 to 3: 1,500 mg
  - ➢ Ages 4 to 8: 1,900 mg
  - ➢ Ages 9 to 13: 2,200 mg
  - ➢ Ages 14 to adult: 2,300 mg
  - ➢ Sodium sensitive: 1,500 mg
- ✓ Sensitive populations include
  - ➢ Adults over 50
  - ➢ Blacks
  - ➢ Those diagnosed with hypertension
  - ➢ Those with diabetes
  - ➢ Those with chronic kidney disease

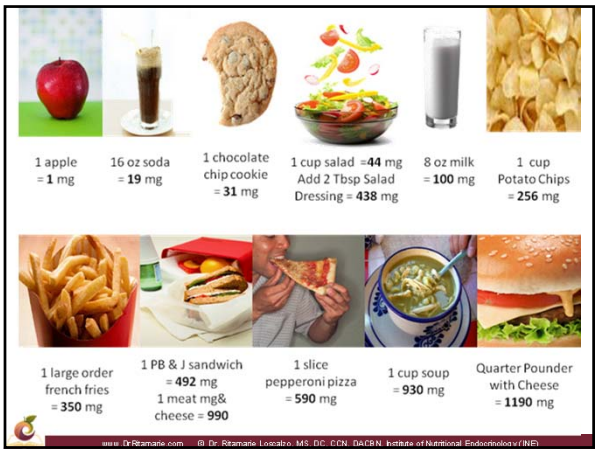


Symptoms of Excessive Sodium

- ✓ Edema
- ✓ High blood pressure
- ✓ Potassium deficiency
- ✓ Liver disease
- ✓ Kidney disease
- ✓ Bone weakness and osteoporosis
- ✓ Stupor
- ✓ Coma

Food Sources of Sodium

- ✓ Kelp
- ✓ Stinging nettle
- ✓ Olives
- ✓ Dulse
- ✓ Sauerkraut
- ✓ Irish moss
- ✓ Chinese cabbage
- ✓ Chinese mustard
- ✓ Lettuce
- ✓ Turnip
- ✓ Spinach
- ✓ Carrots
- ✓ Watercress
- ✓ Dandelion greens
- ✓ Tomatos
- ✓ Radish root
- ✓ Celery
- ✓ Scallop
- ✓ Lobster
- ✓ Beet greens
- ✓ Beets



Condiment Sources of Sodium

- ✓Kelp
- ✓Dulse
- ✓Celery seed
- ✓Sesame seed
- ✓Turmeric
- ✓Dill
- ✓Cumin
- ✓Nettle

Classes of Medications that Deplete Sodium

- ✓Diuretics
- ✓Non-steroidal anti-inflammatory drugs (NSAIDs)
- ✓Opiate derivatives
- ✓Selective serotonin re-uptake inhibitors (SSRIs)
- ✓Phenothiazines
- ✓Tricyclic antidepressants

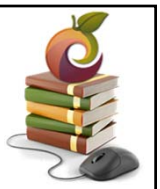
Medications that Deplete Sodium

- ✓Chlorpropamide (Diabinese)
- ✓Cyclophosphamide (Cytoxan)
- ✓Desmopressin (DDAVP; nasal or oral)
- ✓Clofibrate (Atromid-S)
- ✓Oxytocin (Pitocin)
- ✓Vincristine (Oncovin)

Assessing Status of Sodium

- ✓Serum level (135-140)
- ✓Ratio to serum level of potassium and chloride
- ✓Diet journal
- ✓Questionnaires and good history taking for signs and symptoms

Resources



- ✓ *Advanced Nutrition and Human Metabolism – Gropper, Smith and Groff*
- ✓ Linus Pauling Institute: http://www.drritamarie.com/go/LPISodium
- ✓ http://www.drritamarie.com/go/AbsorptionOfNaAndCl
- ✓ http://www.drritamarie.com/go/SodiumLauritzenAndSaunders