

# Fluid/Na<sup>+</sup> Balance

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10:21 PM

## Learning Objectives:

- relationship between water balance, Na<sup>+</sup> balance, & Osm in states of normal, elevated, & decreased Na/H<sub>2</sub>O balance
- fluid distribution into body compartments & regulation
- how fluid exchange with environment occurs (factors that alter fluid exchange)
- volume status & contributions to the volume status

## Total Body Water

Men	TBW = 60% of Weight
Women	TBW = 50% of Weight

**EFFECTIVE OSMOLES** - solutes that affect fluid shifts b/c they cannot diffuse across membranes

**Na<sup>+</sup>/K<sup>+</sup>/ATPase** - maintains equal osmolality

**TONICITY** - determined by effective osmoles

**HYPOTONIC** - ↓ sOsm

**ISOTONIC** - normal sOsm

**HYPERTONIC** - ↑ sOsm

$$sOsm = 2(Na) + G/18 + BUN/2.8$$

## 4 Principles of H<sub>2</sub>O/Na Regulation:

- 1) homeostasis responds to changes in ECF
- 2) no receptors directly monitor balance
- 3) water cannot be moved by active transport
- 4) in = out

**HYPOTHALAMIC OSMORECEPTORS** - monitor plasma volume & osmotic concentration

$$\text{Daily Input: } 2500 = \frac{1200}{\text{(drink)}} + 1000 + 300 \text{ (metabolism)}$$

$$\text{Daily Output: } 2500 = \frac{1200}{\text{(urine)}} + 150 \text{ (stool)} + (400 + 750) \text{ (lungs) (evap)}$$

## Decrease Fluid Requirement:

- fluid overload
- HF
- urinary retention
- CKD

**HYDROSTATIC PRESSURE** - blood vessels --> ECF

**COLLOID PRESSURE** - ECF --> blood vessels

- ↑ ECF, ↓ ADH/Aldo (*non-osmotic*)

- ↑ sOsm, ↑ ADH (*osmotic*)

**DEHYDRATION** - ↓ hypotonic fluid from TBW ( $\uparrow$ sOsm, Na+, Specific Gravity) (Uvol >3L)

**VOLUME DEPLETED** - ↓ isotonic from BV (normal Osm, Na+, Specific Gravity) (Uvol <3L)

- heart issues

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### Hypertatremia ( $\uparrow$ Na+)

- OSMOTIC DIURESIS -  $\uparrow$  solute,  $\uparrow$  urine

- DIABETES INSIPIDUS - kidneys can't concentrate urine

- SODIUM OVERLOAD - hypertonic saline infusion --> hyperchloremic ( $\uparrow$ Cl-) METABOLIC ACIDOSIS

### Hyponatremia ( $\downarrow$ Na+)

<b>Mild</b>	-10	asympt, N, malaise
<b>Moderate</b>	-20	headaches, fatigue, restless, disoriented
<b>Severe</b>	-30	seizures, coma, respiratory arrest, brainstem herniation, death

<b>Chronic</b>	>48hrs	mild
<b>Acute</b>		severe

### Euvolemic Hypotonic Hyponatremia

<b>Uosm</b>	>100	< 100
<b>UNa</b>	>20	<20
	exclude HoT, CKD, SIADH	low solute intake

**SIADH** - symptoms of inappropriate ADH

### Hypervolemic Hypotonic Hyponatremia

<b>Uosm</b>	>100
<b>UNa</b>	<20
	CHF, Cirrhosis, Nephrosis