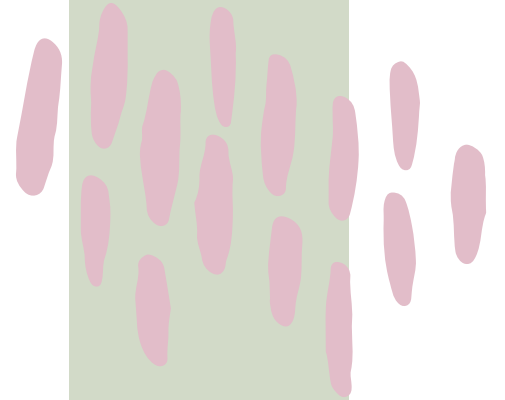


# OSMOLALITY IN SERUM AND URINE



# Osmolality and Osmolarity

- **Osmolarity** is the concentration of a solution in terms of osmoles of solutes per **liter of solution** → Expressed as (**Osm/Liter**).
- **Osmolality** is the concentration of a solution in terms of osmoles of solutes per **kilogram of solvent** → Expressed as (**Osm/kg**).
- The amount of osmotically active particles in a biological fluid is expressed in **osmoles**.
- 1 mol/L of **NaCl** corresponds to an osmolarity of 2 osmol/L (**Na<sup>+</sup> / Cl<sup>-</sup>**)

## Osmolality test:

The osmolality test provides a snapshot of the **number of solutes** present in the blood (serum), urine, or stool.

# Osmometer

- Is a device used in clinical laboratories for measuring the concentration of particles in a solution, known as the **osmolar concentration**.
- This quantity can be expressed as **osmolality** (in Osm/kg) or **osmolarity** (in Osm/L).

## Types of osmometers:

1. **Membrane Osmometers:** measure the osmotic pressure of a solution separated by a semi-permeable membrane.
2. **Vapor Pressure Osmometers:** determine the concentration of osmotically active particles that reduce the vapor pressure of the solution.
3. **Freezing Point Osmometer:** determine the osmotic strength of solution by utilizing freezing point depression.

# Serum osmolality

1. Serum osmolality is primarily ordered to investigate hyponatremia (low sodium in serum).
2. **Normal:** Adults: 280–303 mOsm/kg H<sub>2</sub>O

	Cause
Higher than normal levels ( <b>hyperosmolality</b> )	<ul style="list-style-type: none"><li>▪ Dehydration.</li><li>▪ Azotemia.</li><li>▪ Chronic renal disease.</li><li>▪ High sodium level (<b>hypernatremia</b>).</li><li>▪ Diabetes mellitus.</li><li>▪ Diabetes insipidus.</li></ul>
Lower than normal levels ( <b>hypoosmolality</b> )	<ul style="list-style-type: none"><li>▪ Loss of sodium with diuretics and low-salt diet (<b>hyponatremia</b>).</li><li>▪ Syndrome of Inappropriate antidiuretic hormone secretion (SIADH).</li><li>▪ Excess hydration</li></ul>

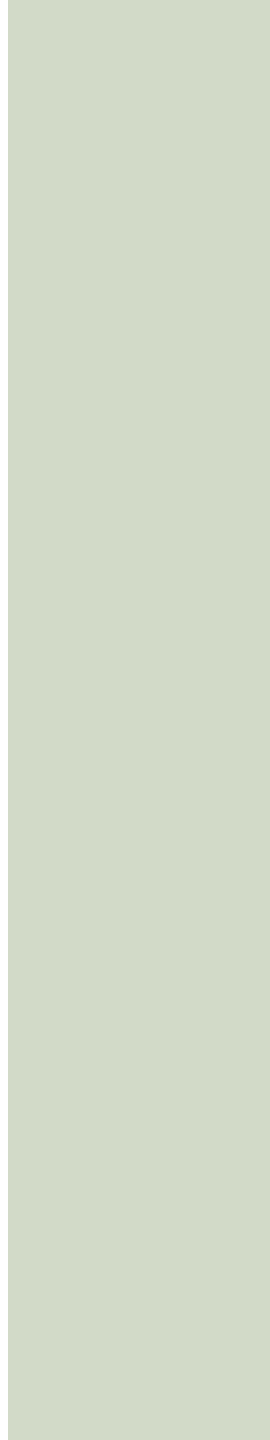
# Urine osmolality

- **Urine osmolality** is frequently ordered along with **serum osmolality**.
- This test helps check your **body's water balance** and **urine concentration**.
- **Osmolality** is a **more exact** measurement of urine concentration than the urine **specific gravity test**. *Why?*
- **Normal:** 24-hour: 300–900 mOsm/kg H<sub>2</sub>O, Random: 50–1400 mOsm/kg H<sub>2</sub>O

	Cause
Higher than normal levels ( <b>hyperosmolality</b> )	<ul style="list-style-type: none"><li>• Dehydration.</li><li>• Pre-renal azotemia.</li><li>• Glycosuria.</li><li>• Syndrome Inappropriate ADH secretion (SIADH).</li><li>• Hyponatremia</li></ul>
Lower than normal levels ( <b>hypoosmolality</b> )	<ul style="list-style-type: none"><li>• Excessive fluid intake.</li><li>• Diabetes insipidus.</li><li>• Acute renal insufficiency.</li><li>• Hypernatremia.</li></ul>

## Homework:

Explain how diabetes mellitus causes hyponatremia (*mechanism*).



## References

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