

Diuresis

Faciliatators' Team

Objectives:

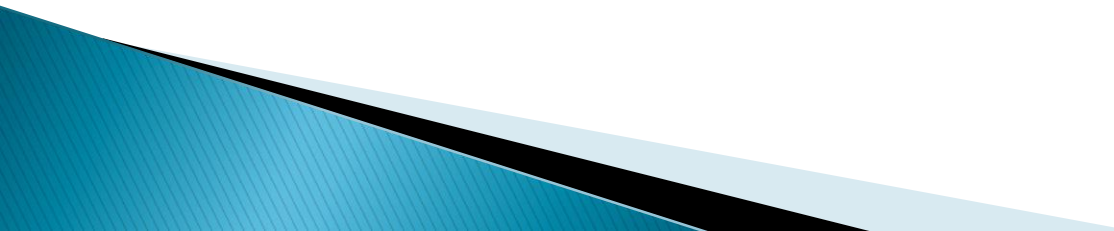
- ▶ To measure the **volumes** and determine the **compositions** of urine excreted by **4** groups:
 1. **Fasting**
 2. **drank 1L water**
 3. **drank 1L saline**
 4. **took 1 tab of Lasix**
- ▶ To be able to discuss the mechanisms by which the body maintain the water and sodium homeostasis in these 4 different conditions.

Group A

- Emptied their bladders at 8:00 am and discarded the urine.
- **From 8:00 they are restricted to take any fluids and they are asked to provide various urine samples for analysis at: 10:00 am, 12:00 noon, 2:00 pm and 3:00 pm.**



Group B

- Emptied their bladder at 10:00 am and discarded the urine.
 - At 12:00 noon emptied their bladder again, but this time they measured its volume and provided a sample for analysis. This sample will be pre-experimental sample.
 - **Drank 1 liter of water immediately after providing the pre-experimental sample.**
 - Were then asked to empty their bladders and provide post-experimental samples every half an hour after drinking water until 3:00 pm.
- 

Group C

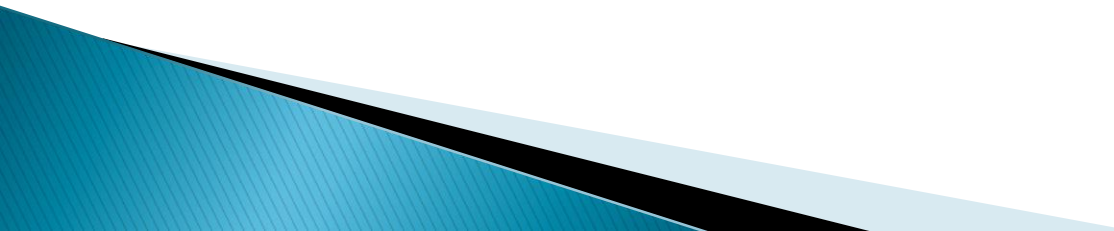
- Emptied their bladder at 7:00 am and discarded the urine.
- At 9:00 am emptied their bladder again, but this time they measured its volume and provided a sample for analysis. This sample will be pre-experimental sample.
- **Drank 1 liter of 0.9% saline (isotonic saline) immediately after providing the pre-experimental sample.**
- Were then asked to empty their bladders and provide post-experimental samples every hour after drinking saline until 3:00 pm.

What is 0.9% saline (isotonic saline)?

- ▶ contains **154 mmol of NaCl**, equivalent to 9 g of salt or 3.6 g of sodium.
- ▶ The sodium concentration of isotonic saline is equivalent to the normal sodium concentration of plasma water.



Group D

- Emptied their bladder at 8:00 am and discarded the urine.
 - At 10:00 am emptied their bladder again, but this time they measured its volume and provided a sample for analysis. This sample will be pre-experimental sample.
 - **Swallowed a Lasix (Furosemide) tablet 40 mg with the help of 25 ml of water immediately after providing the pre-experimental sample.**
 - Were then asked to empty their bladders and provide post-experimental samples every half hour after taking Lasix until 3:00 pm.
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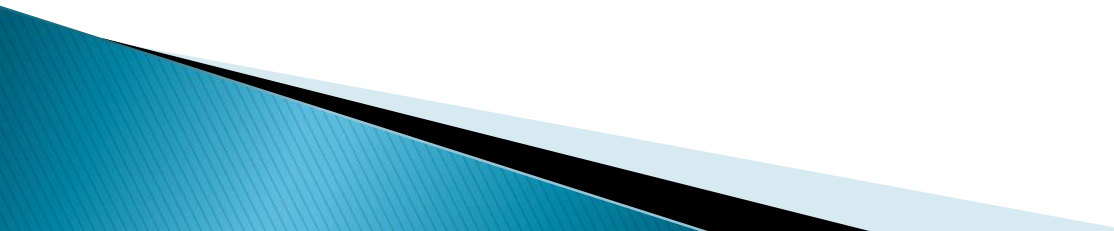
What is Lasix?

Furosemide is a **loop diuretic**
It's also called **osmotic diuretic**
used in the treatment of
**hypertension, congestive
heart failure and edema.**



It **inhibits the sodium-potassium-2 chloride co-transport system** located within the **ascending limb of the Loop of Henle.**

Urine samples used to determine:

- ▶ **Volume** (measuring cylinder)
 - ▶ **Sodium and potassium concentration** (flame photometry)
 - ▶ **PH** (PH meter)
 - ▶ **Osmolality** (Osmometer)
- 



Flame photometry



Osmometer



Measuring cylinder



PH meter

Table of results

| SAMPLE NO. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| COLLECTION TIME (minutes) | | | | | | |
| VOLUME OF URINE (ml) | | | | | | |
| URINE FLOW RATE (ml / min) | | | | | | |
| SODIUM CONCENTRATION (mmoles/liter) | | | | | | |
| TOTAL SODIUM EXCRETION (mmoles) | | | | | | |
| SODIUM EXCRETION RATE (μ moles/min) | | | | | | |

Calculation

- ▶ Total sodium excretion is obtained by applying following equation:

$$\text{Sodium excretion} = \frac{\text{Sodium concentration} \times \text{Volume of urine}}{1000}$$

- ▶ Sodium excretion rate is obtained by applying the following equation:

$$\text{Sodium excretion rate} = \frac{\text{Sodium concentration} \times \text{Volume of urine}}{\text{Time}}$$

Group A

- ▶ **What will happen?**

Subsequent urine sample is lesser in volume and darker yellow in color that shows the kidneys try to conserve water in fasting state.

Group A

Deprive of H₂O

1

↑ Plasma Osmolarity

2

Stimulates Osmoreceptors in anterior hypothalamus

3

↑ Thirst

←

3

↑ ADH secretion from posterior pituitary

↑ H₂O drinking

4

↑ H₂O permeability in late distal tubule and collecting duct

↓

5a

↑ H₂O reabsorption

↓ Plasma Osmolarity Toward Normal

5b

↑ Urine osmolarity and ↓ urine volume

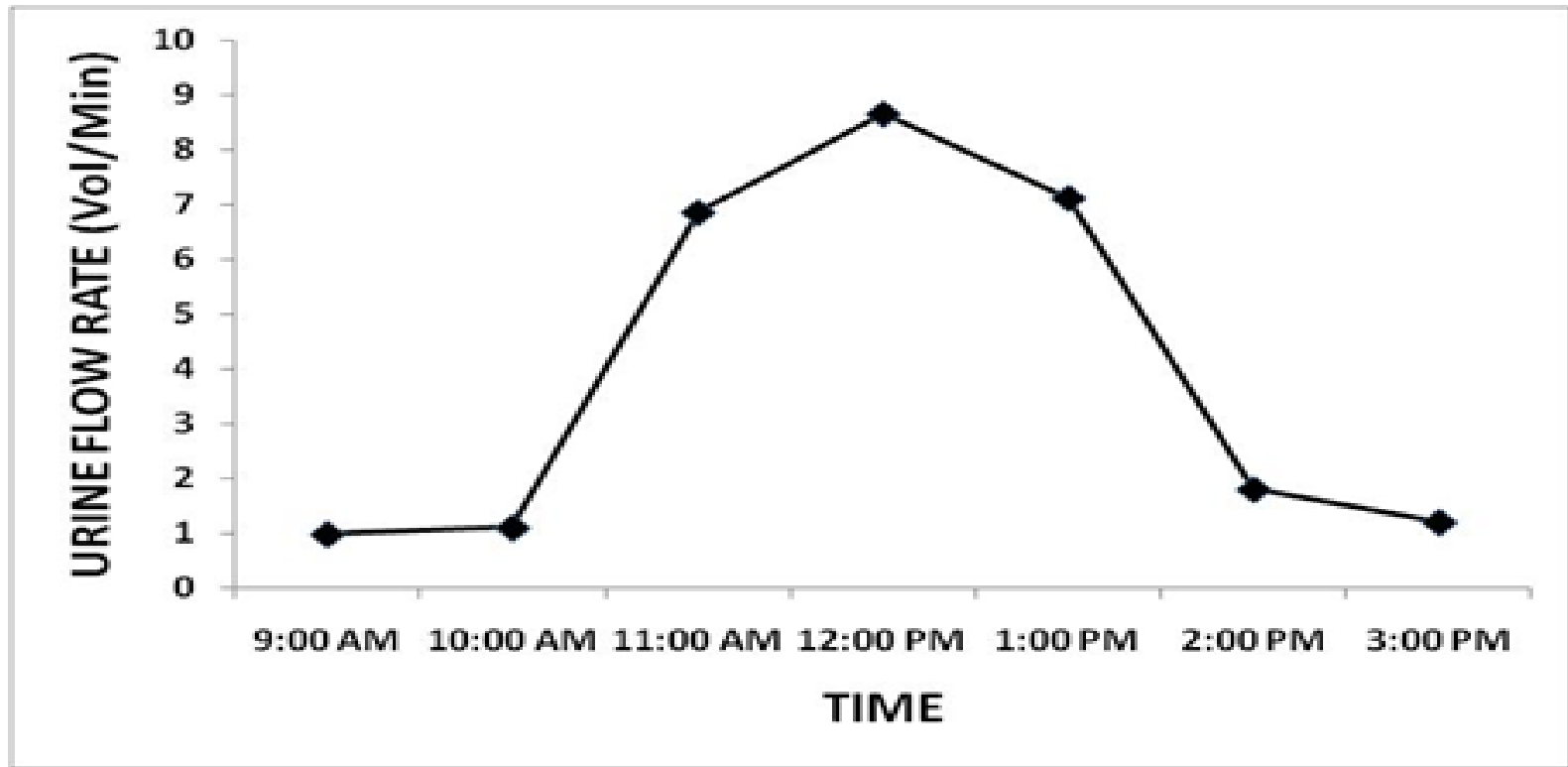
←

6

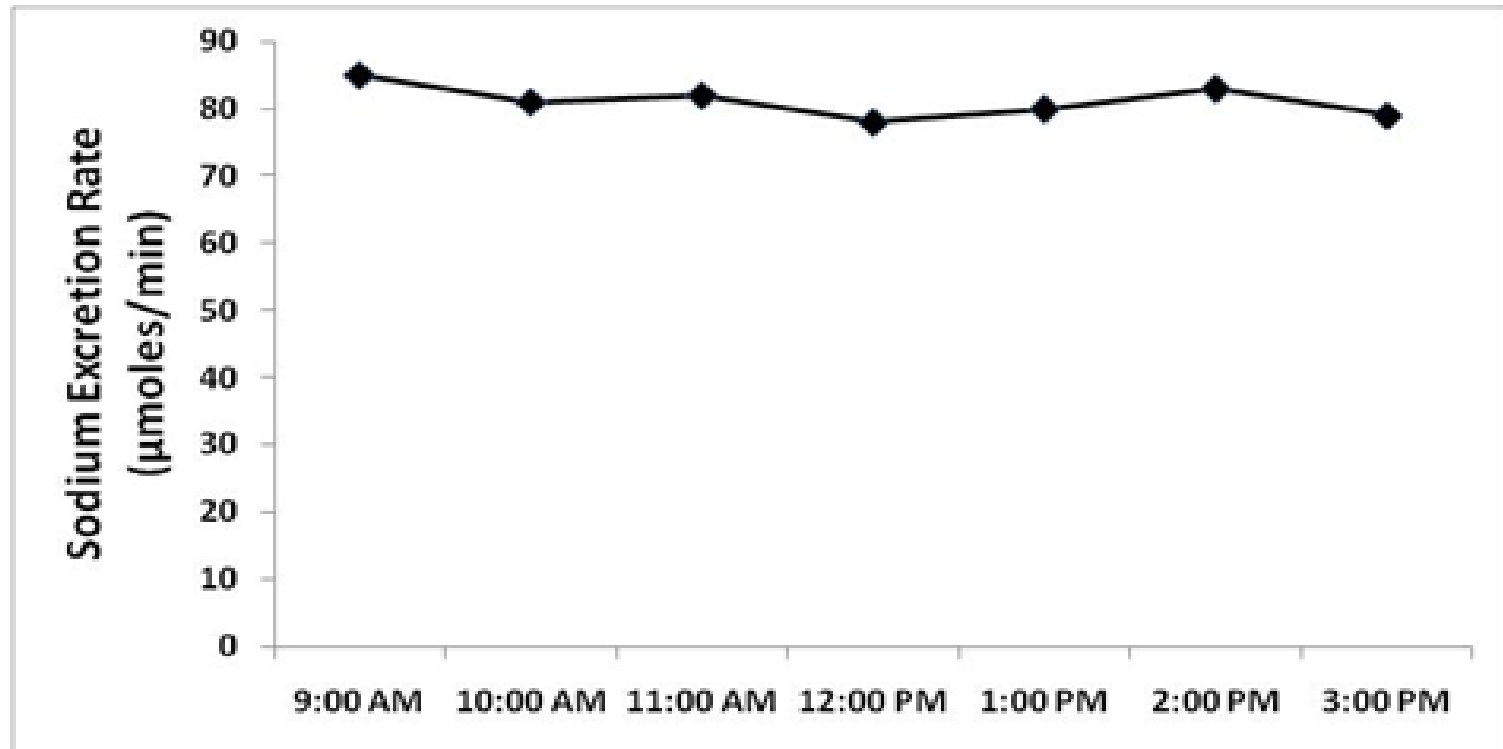
Group B results

| SAMPLE NO. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|------|------|------|------|------|-----|------|
| COLLECTION TIME (minutes) | 120 | 30 | 30 | 30 | 30 | 30 | 30 |
| VOLUME OF URINE (ml) | 118 | 33 | 206 | 260 | 214 | 54 | 36 |
| URINE FLOW RATE (ml / min) | 0.98 | 1.1 | 6.87 | 8.67 | 7.13 | 1.8 | 1.2 |
| SODIUM CONCENTRATION (mmoles/liter) | 87 | 56 | 12 | 9 | 10 | 25 | 53 |
| TOTAL SODIUM EXCRETION (mmoles) | 10.3 | 1.8 | 2.5 | 2.3 | 2.1 | 1.4 | 1.9 |
| SODIUM EXCRETION RATE (μ moles/min) | 85.6 | 61.6 | 82.4 | 78 | 71.3 | 45 | 63.6 |

Group B



Group B



Group B

Drink 1 L H₂O

1

↓ Plasma Osmolarity

Inhibits osmoreceptors in anterior hypothalamus

↓ ADH secretion from posterior pituitary

↓ H₂O permeability in late distal tubule and collecting duct

↓ H₂O reabsorption and excretion

↓ Urine Osmolarity and urine volume

2

3

4

5a

5b

3

6

↓ Thirst

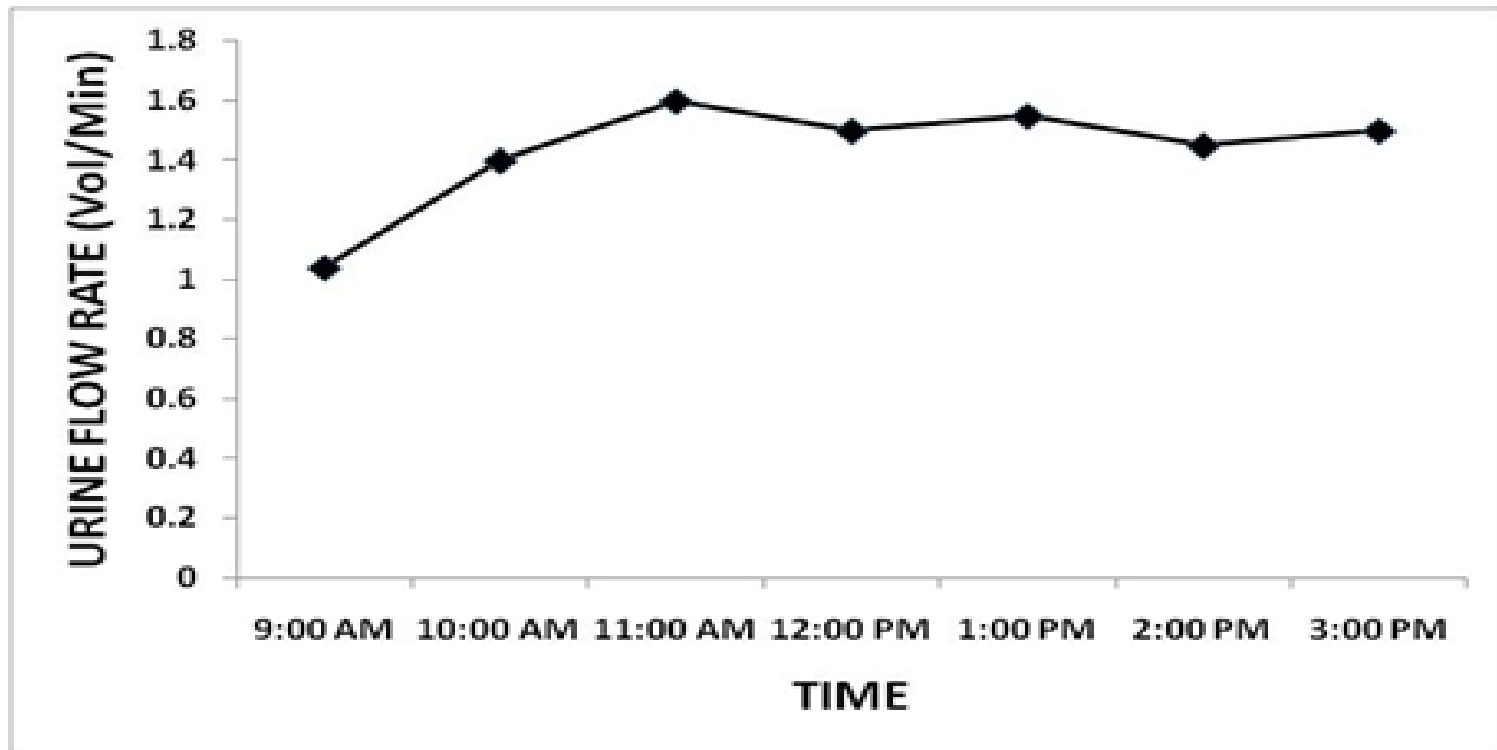
↓ H₂O drinking

↑ Plasma osmolarity toward Normal

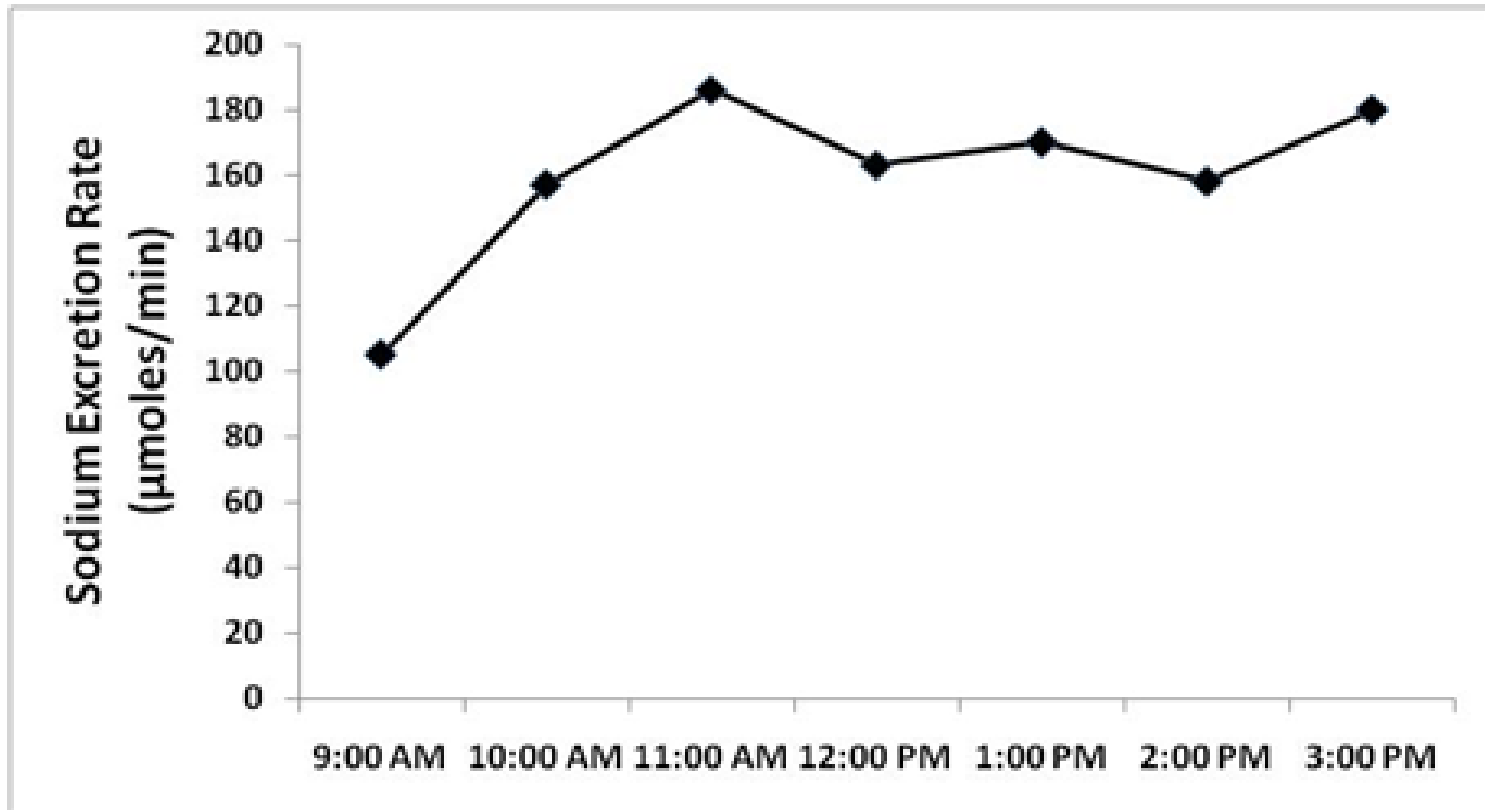
Group C results

| SAMPLE NO. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|-------|-------|-------|-------|-------|-------|-------|
| COLLECTION TIME (minutes) | 120 | 30 | 30 | 30 | 30 | 30 | 30 |
| VOLUME OF URINE (ml) | 125 | 39 | 50 | 42 | 47 | 32 | 45 |
| URINE FLOW RATE (ml / min) | 1.04 | 1.30 | 1.67 | 1.40 | 1.57 | 1.07 | 1.50 |
| SODIUM CONCENTRATION (mmoles/liter) | 101 | 98 | 112 | 109 | 120 | 137 | 127 |
| TOTAL SODIUM EXCRETION (mmoles) | 12.6 | 3.8 | 5.6 | 4.6 | 5.6 | 4.4 | 5.7 |
| SODIUM EXCRETION RATE (μ moles/min) | 105.2 | 127.4 | 186.7 | 152.6 | 188.0 | 146.1 | 190.5 |

Group C



Group C



Group C

Isotonic Saline (0.9%)
1 liter

↑ Volume of E.C.F. Osmolality
same (as isotonic saline) total
solute amount ↑

↑ Stretch on right atrium (volume
receptors in right atrium)

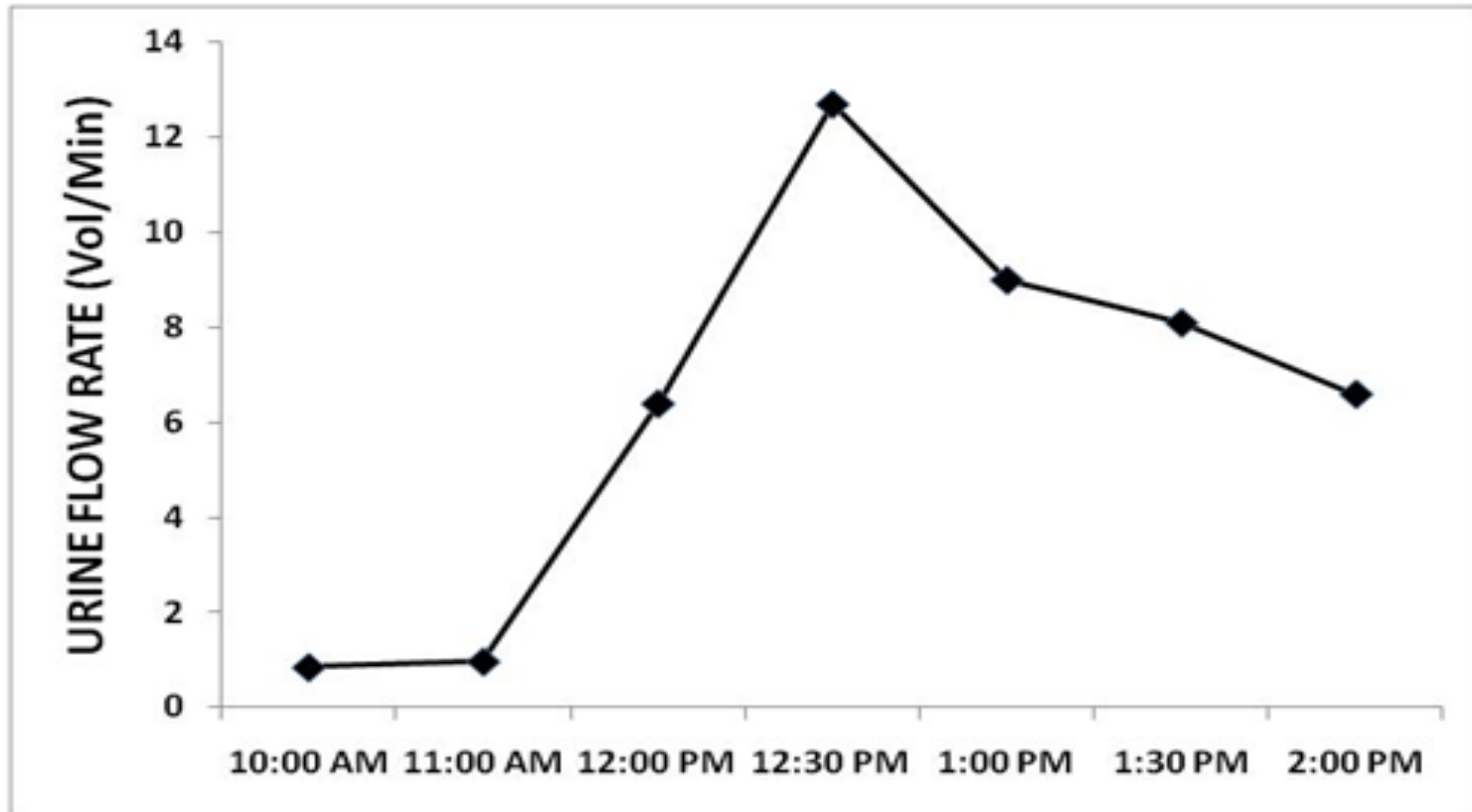
↑ ANP (Atrial Natriuretic peptide)

↑ Na excretion by Kidneys

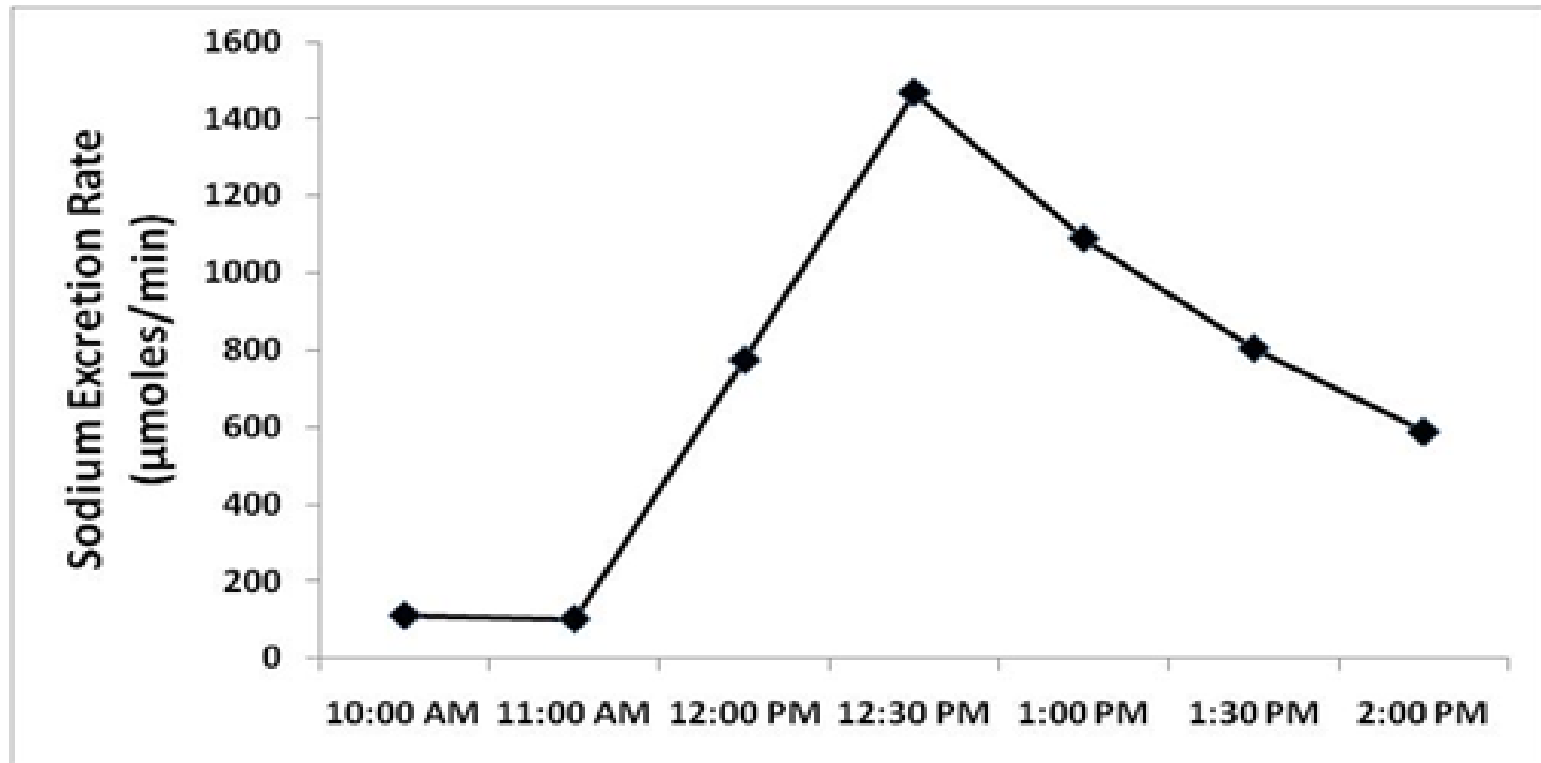
Group D results

| SAMPLE NO. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|-------|------|------|------|------|-------|
| COLLECTION TIME (minutes) | 120 | 60 | 42 | 18 | 30 | 30 |
| VOLUME OF URINE (ml) | 102 | 58 | 269 | 230 | 270 | 125 |
| URINE FLOW RATE (ml / min) | 0.85 | 0.97 | 6.4 | 12.7 | 9.0 | 4.2 |
| SODIUM CONCENTRATION (mmoles/liter) | 132 | 107 | 121 | 115 | 121 | 117 |
| TOTAL SODIUM EXCRETION (mmoles) | 13.5 | 6.2 | 32.5 | 26.4 | 32.6 | 14.6 |
| SODIUM EXCRETION RATE (μ moles/min) | 112.2 | 103 | 774 | 1467 | 1089 | 487.5 |

Group D



Group D



Group D



1 tab of Lasix (furosemide)
(40mg)
with 25ml of water

Action starts 1–2 hours and lasts
for 4–6 hours
(1/2 life of furosemide is 6hr)

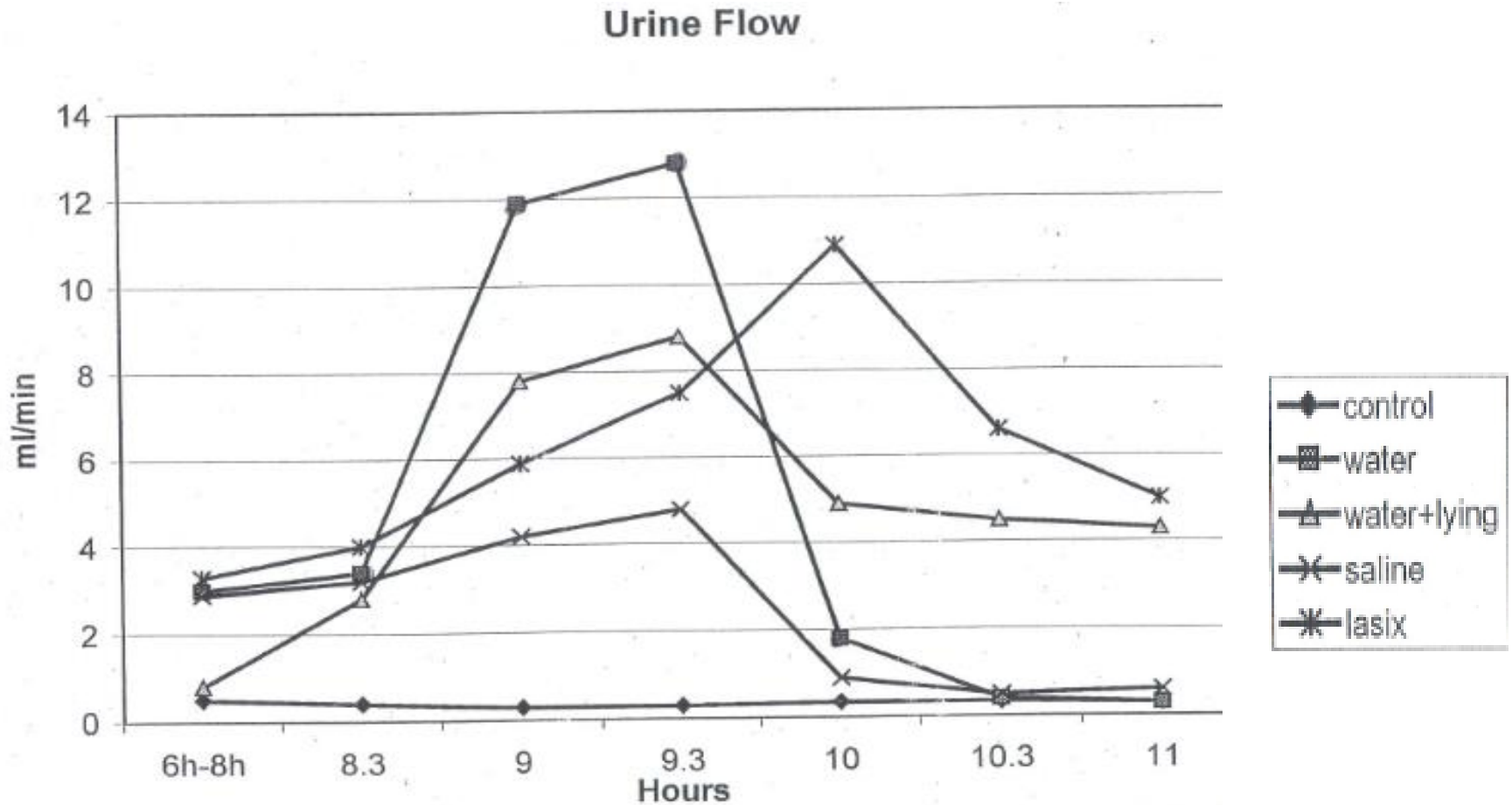


Acts **on thick ascending limb of
loop of Henle** and blocks the Na-
K-2Cl co-transport (called loop
diuretic)

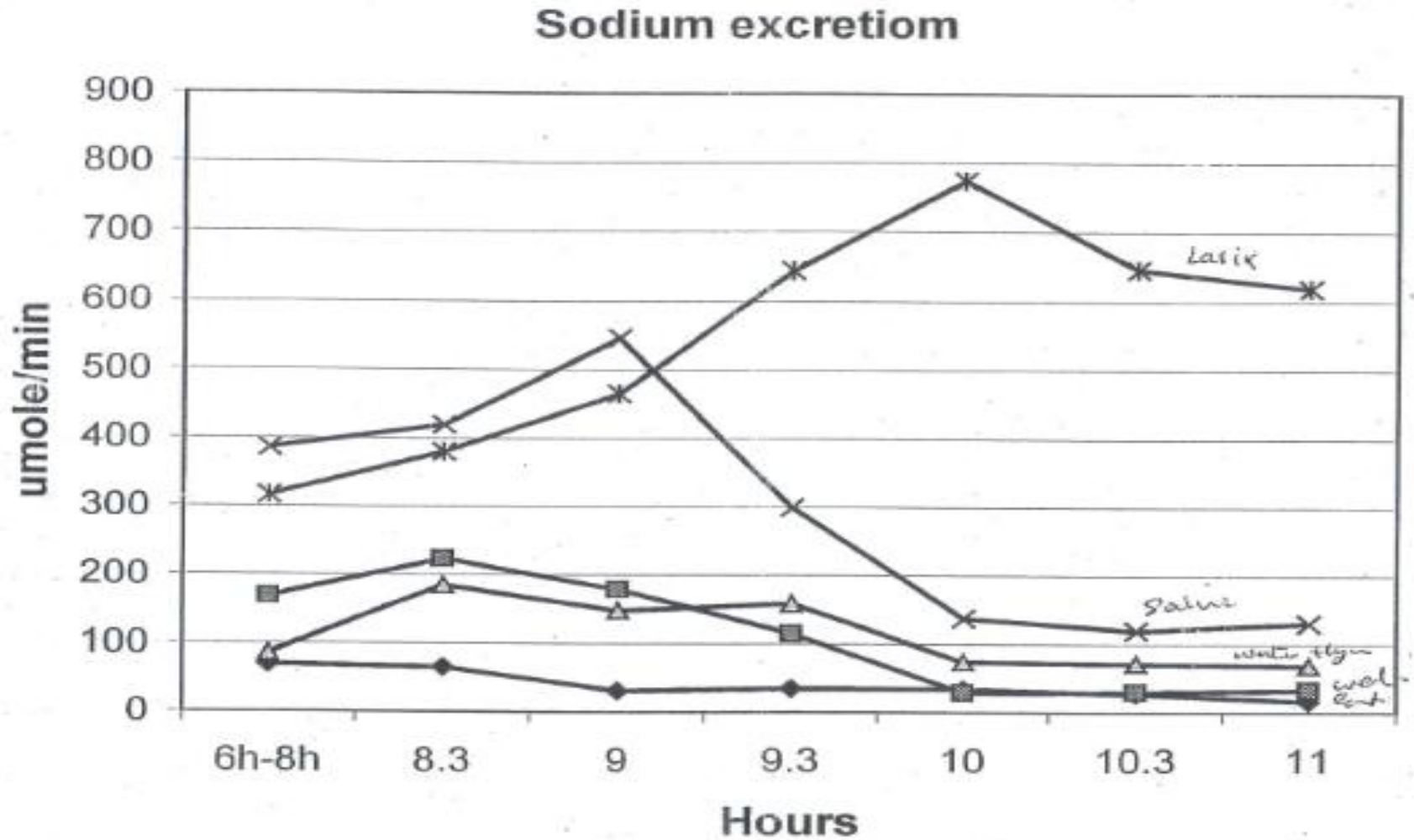


 Na excretion in urine and 
water excretion (osmotic drag)

Urine Flow Rate for all groups



Sodium Excretion Rate for all groups



Thank you

