

Biochemistry of biological fluids (BIOCH 472)

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Class 5:

Urinalysis: Urine collection

Objectives for this lecture

- List the major constituents of urine.
- describe the methodology for accepting and labeling urine specimens.
- Discuss the methods for preserving urine specimens.



Urine Composition

- Urine composition

(95%)
water

(5%)
dissolved solutes:

(2.5 %)
Urea: (half)

(2.5 %)
Other compounds

Inorganic:

Cl⁻, Na, K.

trace amounts of:
sulfate, Phosphate,
Ammonia,
Magnesium,
Calcium

Organic:

Creatinine
Uric acid
Hippuric acid
Other substances

Urine Composition

- Ultrafiltrate of plasma converts 170,000 mL of filtered plasma to the daily urine output of 1200 mL. (*normal 600-2000 mL*)
- Urine solutes concentrations are affected by:
 - dietary intake
 - physical activity
 - body metabolism
 - endocrine functions
 - body position.

Urine Composition

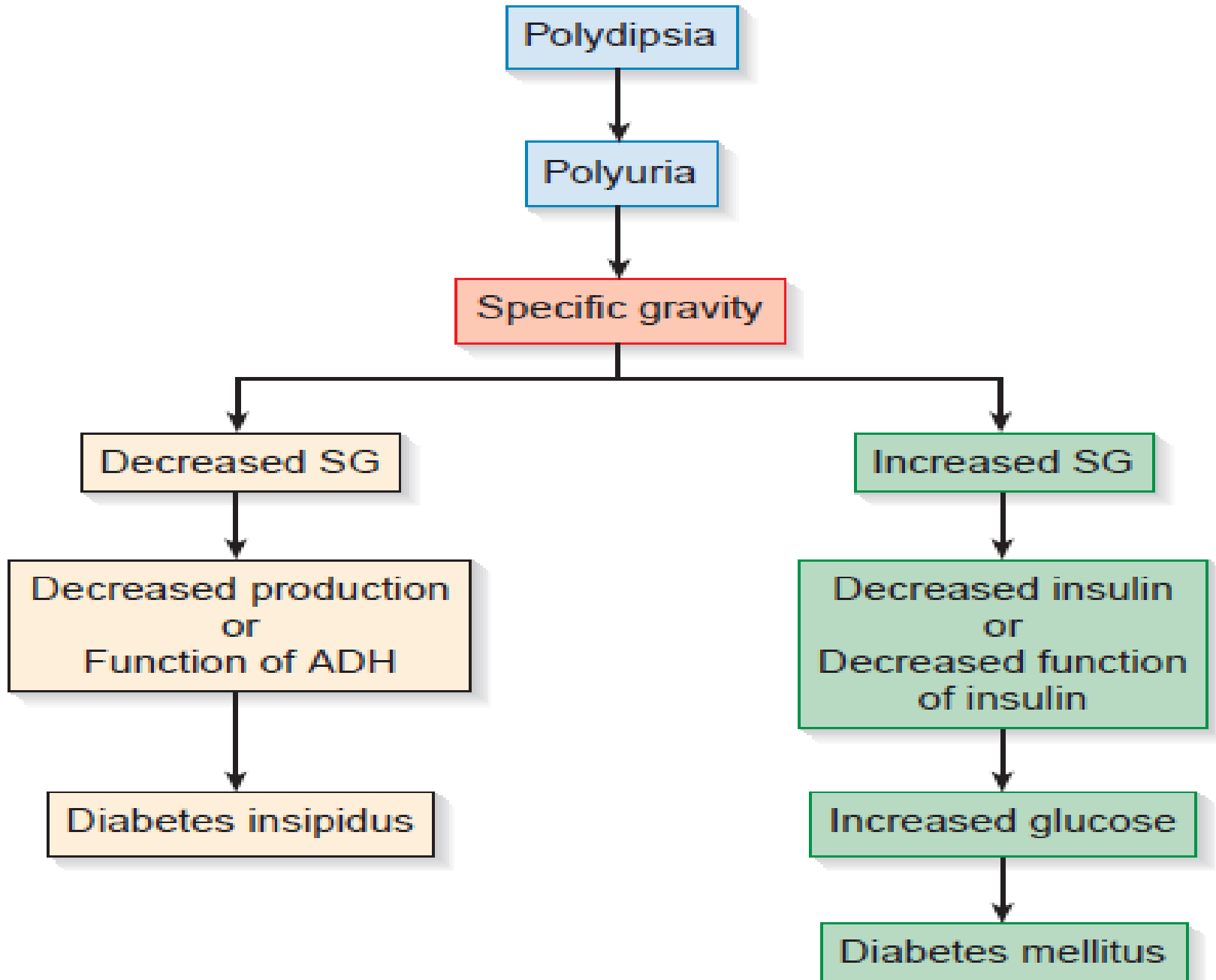
- Other substances found in urine include:
 - hormones, vitamins, and medications.
 - formed elements, such as cells, casts, crystals, mucus, and bacteria.
- Increased amounts of these formed elements are often indicative of disease.

Urine Volume

- ***Oliguria***: decrease urine output
 - ✓ (less than 400 mL/day in adults)
 - ✓ excessive water loss from vomiting, diarrhea, perspiration, or severe burns
 - ✓ damage to the kidneys
 - ✓ decrease in the flow of blood to the kidneys

Urine Volume

- ***Polyuria (nocturia)***: increase in daily urine volume.
 - ✓ (greater than 2.5 L/day in adults)
 - ✓ with diabetes mellitus and diabetes insipidus
 - ✓ diuretics, caffeine, or alcohol (*suppress ADH*)



Specimen Collection



- urine is a **biohazardous** substance
- collected in disposable clean, dry, leak-proof **containers**.
- Attach **Label** to the container (*patient details*)
- requisition **form** (manual or computerized) must accompany specimens
- Lab should write the conditions for specimen rejection

Specimen Handling

- Specimens should be tested within 2 hours.
- Use: - refrigerated (for culture).
- chemical preservative (transport long distance).
- Composition changes are related to the presence and growth of bacteria.
- Refrigeration: - increase specific gravity (SG)
- precipitate Amo. Phos., Urates
(specimen must return to room temp.)

Table 3-2

Changes in Unpreserved Urine

Analyte	Change	Cause
Color	Modified/darkened	Oxidation or reduction of metabolites
Clarity	Decreased	Bacterial growth and precipitation of amorphous material
Odor	Increased	Bacterial multiplication or breakdown of urea to ammonia
pH	Increased	Breakdown of urea to ammonia by urease-producing bacteria/ loss of CO ₂
Glucose	Decreased	Glycolysis and bacterial use
Ketones	Decreased	Volatilization and bacterial metabolism
Bilirubin	Decreased	Exposure to light/photo oxidation to biliverdin
Urobilinogen	Decreased	Oxidation to urobilin
Nitrite	Increased	Multiplication of nitrate-reducing bacteria
Red and white blood cells and casts	Decreased	Disintegration in dilute alkaline urine
Bacteria	Increased	Multiplication

Types of Specimens

- **Random Specimen**
 - Routine screening
- **First Morning Specimen**
(concentrated, 8 h)
 - Routine screening
 - Pregnancy tests
 - Orthostatic protein
- **Fasting Specimen**
(second morning)
 - Diabetic screening/monitoring

Types of Specimens

- 2-hour postprandial
 - Diabetic monitoring
- Glucose tolerance test
 - Correspond with **blood**
- 24-h (or timed)
 - Quantitative chemical tests
- Catheterized (*bladder*)
 - Bacterial culture
- Suprapubic aspiration (abdomen needle)
 - Bladder culture
 - Cytology
- Midstream clean-catch
 - Routine/culture
- Three-glass collection
 - Prostatic infection