

Organ Function Tests

Introduction of Organ Function Tests

- Organ Function Tests (OFTs) are clinical laboratory investigations used to assess the physiological performance of specific organs. These tests help in:
 - Diagnosing diseases
 - Monitoring disease progression
 - Evaluating therapy effectiveness
 - Screening for subclinical dysfunctions

Purpose of Organ Function Tests

- To detect functional abnormalities in major organs.
- To differentiate between similar clinical conditions.
- To monitor organ damage due to drugs, infections, or systemic diseases.
- To assess baseline function before surgeries or treatment (e.g., chemotherapy).

Types of Organ Function Tests

Organ	Function Evaluated	Examples of Tests
Kidney	Excretion, filtration, electrolyte balance, pH control	Serum creatinine, urea, BUN, eGFR, electrolytes, urinalysis
Liver	Metabolism, detoxification, bile production, synthesis	ALT, AST, ALP, bilirubin, albumin, PT/INR
Heart	Cardiac muscle damage, myocardial function	Troponins, CK-MB, LDH, BNP
Lungs	Gas exchange, pulmonary capacity	Arterial blood gases (ABG), spirometry
Pancreas	Endocrine (insulin) and exocrine (digestive enzyme) roles	Blood glucose, amylase, lipase
Thyroid	Hormonal regulation of metabolism	TSH, T3, T4
Lipid System	Cholesterol and fat transport	Total cholesterol, LDL, HDL, triglycerides

Functions of the Kidney

The kidneys are vital organs responsible for several critical physiological functions. These include:

A. Excretion of Waste Products:

- Removal of nitrogenous wastes such as urea, creatinine, and uric acid, which are byproducts of protein and nucleic acid metabolism.

B. Regulation of Water and Electrolyte Balance:

- Maintains balance of sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), chloride (Cl^-), and phosphate, which are essential for cellular functions.

C. Regulation of Acid-Base Balance:

- Helps maintain blood pH by excreting hydrogen ions (H^+) and reabsorbing bicarbonate (HCO_3^-).

D. Endocrine Functions:

- **Erythropoietin:** Stimulates red blood cell production in response to hypoxia.
- **Renin:** Regulates blood pressure through the renin-angiotensin-aldosterone system.
- **Calcitriol (active form of vitamin D):** Regulates calcium and phosphate metabolism.

E. Regulation of Blood Pressure:

- Through control of blood volume and the renin-angiotensin system.

Routine Kidney Function Tests (Renal Function Tests - RFTs)

These tests assess different aspects of renal function and help diagnose acute or chronic kidney diseases.

1. Blood Urea Nitrogen (BUN):

- **Definition:** Measures the concentration of urea nitrogen in the blood.
- **Normal range:** 7–20 mg/dL.
- **Clinical significance:**
 - Elevated in renal dysfunction, dehydration, high-protein diet, GI bleeding.
 - Decreased in liver disease, malnutrition, overhydration.

2. Serum Creatinine:

- **Definition:** Creatinine is a waste product of muscle metabolism, filtered by the kidneys.
- **Normal range:**

- Men: 0.7–1.3 mg/dL
- Women: 0.6–1.1 mg/dL

➤ **Clinical significance:**

- Elevated in kidney impairment.
- More specific than BUN for renal function because it is less affected by diet and hydration.

3. **BUN/Creatinine Ratio:**

➤ **Normal ratio:** 10:1 to 20:1.

➤ **Clinical significance:**

- Increased in prerenal causes of kidney dysfunction (e.g., dehydration).
- Decreased in liver disease or postrenal obstruction.

4. **Estimated Glomerular Filtration Rate (eGFR):**

➤ **Definition:** Calculated from serum creatinine, age, sex, and race; estimates the rate at which the kidneys filter blood.

➤ **Normal value:** $>90 \text{ mL/min/1.73 m}^2$.

➤ **Clinical significance:**

- <60 indicates chronic kidney disease (CKD).
- <15 indicates kidney failure (end-stage renal disease).

5. **Creatinine Clearance Test (CCT):**

➤ **Definition:** Measures the rate at which creatinine is cleared from the blood by the kidneys.

➤ **Normal range:** 90–140 mL/min (varies by age, sex, and body size).

➤ **Clinical significance:**

- Reflects GFR; reduced in renal impairment.
- Requires 24-hour urine collection and a serum creatinine test.

6. **Urinalysis:**

➤ **Includes:** Physical, chemical, and microscopic examination of urine.

➤ **Tests involved:**

- **Proteinuria:** Presence of protein (especially albumin) suggests glomerular damage.
- **Hematuria:** May indicate infection, stones, or glomerular disease.
- **Specific gravity:** Assesses concentrating ability of the kidney.

- **Urine pH:** Reflects acid-base status.
- **Clinical significance:**
 - Provides clues to both acute and chronic kidney disease.

7. Microalbuminuria:

- **Definition:** Small amounts of albumin in the urine (30–300 mg/day).
- **Clinical significance:**
 - Early indicator of diabetic nephropathy and cardiovascular risk.
 - Used in screening diabetic and hypertensive patients.

Functions of the Liver

The liver is a vital organ with multiple metabolic, synthetic, detoxifying, and storage functions. These include:

A. Metabolic Functions

- **Carbohydrate metabolism:** Glycogenesis, glycogenolysis, and gluconeogenesis.
- **Protein metabolism:** Deamination of amino acids, urea synthesis.
- **Lipid metabolism:** Synthesis and breakdown of cholesterol, lipoproteins, triglycerides.

B. Synthetic (Biosynthetic) Functions

- **Plasma proteins:** Synthesis of albumin, clotting factors (fibrinogen, prothrombin, factors VII, IX, X).
- Lipoproteins and apolipoproteins.

C. Detoxification

- Biotransformation of drugs, hormones, and toxins.
- Conversion of ammonia to urea (urea cycle).

D. Bile Formation and Secretion

- Excretion of bilirubin, cholesterol, bile acids.
- Essential for fat digestion and absorption.

E. Storage Functions

- Stores glycogen, vitamins (A, D, B12, K), iron, and copper.

F. Immune Function

- Kupffer cells in liver sinusoids act as macrophages, clearing pathogens and debris.



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