

## Proteins

### Clinical Background

Hepatic proteins is a term used to refer to a group of proteins synthesized in the liver that may be used in the assessment of nutritional status. Hepatic proteins include

- Albumin
- Prealbumin (transthyretin)
- Retinol-binding protein (RBP)
- Transferrin

### Etiologies

- Starvation
- Chronic disease
  - HIV
  - Malignancy
  - Chronic liver disease
  - Chronic kidney disease
  - Chronic obstructive pulmonary disease (COPD)
- Anorexia
- Malabsorption
- Critical illness or trauma

### Pathophysiology

- Albumin
  - Function – carrier protein for minerals, fatty acids, vitamins and hormones; the most abundant protein in human plasma (55-65% of total protein content)
  - Most commonly monitored protein – long half-life (20 days) makes it a relatively insensitive marker
- Prealbumin (transthyretin)
  - Function – carrier protein for thyroid hormone
  - Prealbumin has 2-day half-life versus albumin (20-day half-life)
    - Short half-life makes it a good indicator for early monitoring
    - Unaffected by hydration status
- RBP
  - Function – responsible for binding and transporting retinol (vitamin A)
  - Short half-life (11 hours) makes it an excellent indicator of early malnutrition
- Transferrin
  - Function – carrier protein for iron
  - Presence of transferrin in serum and other body fluids aids in differential diagnosis
- Alpha-1-antitrypsin (fecal)
  - Function – protease inhibitor

### Clinical Presentation

- Constitutional – weight loss, muscle wasting, fatigue, failure to thrive (children)
- Skin changes from vitamin deficiencies may occur in chronic loss
- Extremes – kwashiorkor manifesting with ascites, edema

## Diagnosis

- Indications for testing
  - Patient with known disease that would cause compromised nutritional status (eg, cancer, malabsorption), children with failure to thrive
- Laboratory testing
  - Albumin – usual first line test in evaluating nutritional status
    - Elevated concentrations
      - Dehydration
    - Decreased concentrations are very common
      - Impaired synthesis
        - Primary (eg, liver disease)
        - Secondary (eg, low protein intake)
      - Increased catabolism – result of tissue damage and inflammation
      - Reduced absorption of amino acids – malabsorption or malnutrition
      - Excessive protein loss in urine, feces or skin – glomerulonephritis, nephrotic syndrome, protein losing enteropathy
      - Altered distribution that sequesters large amounts of albumin in extravascular compartment
        - Nephrotic syndrome
        - Congestive heart failure
    - Albumin measurement in urine may aid in early detection of renal involvement in chronic diseases
  - Prealbumin – may be a better early screening test due to short half-life
    - Prealbumin used as marker of nutritional status in
      - Premature infants
      - Cancer patients
      - Surgical patients
    - Prealbumin is a negative acute phase reactant
      - Due to decreased synthesis, prealbumin serum concentrations fall in
        - Inflammation
        - Malignancy
        - Cirrhosis of liver
        - Protein-wasting diseases of gut or kidney
      - Recommended protein measurement in evaluation of nutrition in hospitalized patients
  - RBP, transferrin and fecal alpha-1-antitrypsin – less widely used as screening tests
    - Decreased concentrations of RBP – cystic fibrosis, liver disease
    - Elevated concentrations of transferrin
      - Malnutrition
      - Acute inflammation
      - Infection
      - Renal disorders
      - Red blood cell disorders, including iron deficiency
      - High concentrations can occur in pregnancy and during estrogen administration
    - Decreased concentrations of transferrin
      - Transferrin is a negative acute phase reactant
      - Low concentrations occur in
        - Inflammation
        - Malignancy

- Chronic liver disease
- Protein loss
- Elevated fecal clearance of alpha-1-antitrypsin in protein-losing enteropathy
- Also recommend vitamin/mineral assay testing

## Lab Tests

### Indications for Laboratory Testing

Tests generally appear in the order most useful for common clinical situations. For test-specific information, refer to the test number in the ARUP Laboratory Test Directory on the ARUP Web site at [www.aruplab.com](http://www.aruplab.com).

Test Name and Number	Recommended Use	Limitations	Follow Up
Albumin, Serum or Plasma by Spectrophotometry <b>0020030</b> Method: Spectrophotometry	Evaluate production of albumin by liver; assess nutritional status Assess nephrotic syndrome and protein-losing enteropathy	Albumin may be acutely decreased in sepsis or trauma	
Prealbumin, Serum <b>0050435</b> Method: Immunoturbidimetric	Assess nutritional status in premature infants, in cancer patients and surgical patients Recommended protein measurement to evaluate nutritional status in hospitalized patients Assess nephrotic syndrome and protein-losing enteropathy	Prealbumin may be acutely decreased in sepsis, trauma	
Retinol Binding Protein <b>0050467</b> Method: Nephelometry	Indicate early malnutrition, acute and chronic hepatic disease, advanced chronic renal insufficiency and cystic fibrosis Assess nephrotic syndrome and protein-losing enteropathy		
Transferrin, Serum <b>0050570</b> Method: Immunoturbidimetric	Aid in differential diagnosis of malnutrition Monitor iron deficiency anemia		
Alpha-1-Antitrypsin, Feces <b>0099991</b> Method: Radial Immunodiffusion	Order as a follow-up test when protein-losing enteropathy is suspected Serves as a clearance measure; calculations require that serum alpha-1-antitrypsin test also be ordered	Blood in stool or diarrhea may increase clearance	

Alpha-1-Antitrypsin <b>0050001</b> Method: Immunoturbidimetric	Calculations for the alpha-1-antitrypsin fecal test require that this test also be ordered		
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**General References**

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**Related Content**

- Acute Phase Inflammatory Proteins - Acute Phase Reactants
- Malabsorption
- Wilson Disease

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