ΣΥΝΗΘΕΣΤΕΡΕΣ ΕΡΓΑΣΤΗΡΙΑΚΕΣ ΕΞΕΤΑΣΕΙΣ ΜΕ ΔΙΑΤΡΟΦΙΚΗ-ΘΡΕΠΤΙΚΗ ΣΠΟΥΔΑΙΟΤΗΤΑ

ΕΡΓΑΣΤΗΡΙΑΚΑ ΤΕΣΤ	ΑΠΟΔΕΚΤΟ ΕΥΡΟΣ	ΠΕΡΙΓΡΑΦΗ
Αιματολογία		
Αριθμός Ερυθρών Αιμοσφαιρίων (RBC)	4,2-5,4 x 10^6/mm^3(γυναίκες) 4,5-6,2 x 10^6/mm^3 (άνδρες)	Ο αριθμός των ερυθρών αιμοσφαιρίων. Βοηθά στη διάγνωση των αναιμιών.
Αιμοσφαιρίνη (Hb)	12-15g/dL (γυναίκες) 14-17g/dL (άνδρες)	Η αιμοσφαιρίνη που περιέχεται στα ερυθρά αιμοσφαίρια. Βοηθά στη διάγνωση των αναιμιών.
Αιματοκρίτης (Hct)	37-47%(γυναίκες) 40-54%(άνδρες)	Δείχνει το ποσοστό των ερυθρών αιμοσφαιρίων στον συνολικό όγκο αίματος. Βοηθά στη διάγνωση των αναιμιών.
Μέσος Όγκος Ερυθρών (MCV)	80-96μm^3	Το μέγεθος των ερυθρών αιμοσφαιρίων. Βοηθά στη διαχωρισμό μεταξύ των μικροκυτταρικών και μακροκυτταρικών αναιμιών.
Μέση Πυκνότητα αιμοσφαιρίνης ερυθρών (MCHC)	31,5-36pg	Η συγκέντρωση αιμοσφαιρίνης μέσα στα ερυθρά αιμοσφαίρια. Βοηθάει στη διάκριση της σιδηροπενικής αναιμίας.
Αριθμός Λευκών Αιμοσφαιρίων (WBC)	4,8-11,8 x 10^3/mm^3	Ο αριθμός των λευκών αιμοσφαιρίων. Γενική αποτίμηση της ανοσολογικής λειτουργίας με/ή παρουσία λοίμωξης
Χημεία Αίματος		
Πρωτεΐνες Ορού		
Ολική Πρωτεΐνη	6-8g/dL	Τα πρωτεϊνικά επίπεδα δεν είναι ειδικά για την παρουσία ασθένειας και δεν έχουν υψηλή ευαισθησία. Μπορούν να αντανακλούν μειωμένη πρόσληψη πρωτεΐνης, αδιαθεσία ή λοιμώξεις ,αλλαγές στην ενυδάτωση ή στον μεταβολισμό, την εγκυμοσύνη ή τη λήψη φαρμάκων.
Αλβουμίνη	3,5-5,0g/dL	Μπορεί να αντανακλά ασθένεια ή πρωτεϊνο-ενεργειακή δυσθρεψία (Protein – Energy Malnutrition, PEM). Αργεί να ανταποκριθεί σε βελτίωση ή σε επιδείνωση της ασθένειας. Ο ρυθμός σύνθεσής της μειώνεται κατά τη διάρκεια φλεγμονής.
Τρανσφερρίνη	250-380mg/gL (γυναίκες) 215-365mg/dL (άνδρες)	Μπορεί να αντανακλά ασθένεια, πρωτεϊνο-ενεργειακή δυσθρεψία (Protein – Energy Malnutrition, PEM) ή έλλειψη σιδήρου. Είναι ελαφρώς πιο ευαίσθητος σε αλλαγές απ'ότι η αλβουμίνη. Ο ρυθμός σύνθεσής της μειώνεται κατά τη διάρκεια φλεγμονής
Προ-αλβουμίνη (τρανσθυρετίνη)	16-35mg/dL	Μπορεί να αντανακλά πρωτεϊνο-ενεργειακή δυσθρεψία (PEM). Ανταποκρίνεται με μεγαλύτερη ευαισθησία στις αλλαγές της κατάστασης υγείας σε σύγκριση με την αλβουμίνη και την τρανσφερρίνη.
C-αντιδρώσα πρωτεΐνη	<1,00mg/dL	Πρωτεΐνη οξείας φάσης-ένδειξη φλεγμονής ή ασθένειας
Ινωδογόνο	160-450mg/dL	Πρωτεΐνη οξείας φάσης-ένδειξη φλεγμονής ή ασθένειας
Γαλακτικό Οξύ	0,3-2,3mEq/L	Αντανακλά την γαλακτική οξείδωση-αυξημένα επίπεδα σε περιόδους σοβαρής ασθένειας
Ένζυμα Πλάσματος		
Κινάση Κρεατίνης (CK,CPK)	30-135U/L (γυναίκες) 55-170U/L (άνδρες)	Διαφορετικές μορφές της CK βρίσκονται στους μυς, τον εγκέφαλο και την καρδιά. Υψηλά επίπεδα στο αίμα δείχνουν καρδιακή προσβολή, καταστροφή μυϊκού ιστού ή τραματισμό σκελετικών μυών
Γαλακτική Διυδρογενάση (LDH)	208-378IU/L	Η LDH βρίσκεται σε πολλούς ιστούς. Συγκεκριμένοι τύποι ίσως αυξηθούν μετά από καρδιακή προσβολή, καταστροφή πνευμόνων ή ηπατική ασθένεια.
Αλκαλική Φωσφατάση	30-120U/L	Βρίσκεται σε πολλούς ιστούς. Συχνά μετριέται για την αξιολόγηση της ηπατικής λειτουργίας.

Ασπαρτική Αμινοτρανσφεράση (AST, παλιότερα λεγόταν SGOT)	0-35U/L	Συνήθως ελέγχεται για να αποτιμηθεί η ηπατική βλάβη. Αυξάνεται στις περισσότερες ηπατικές ασθένειες. Τα επίπεδά της είναι μερικώς αυξημένα μετά από καταστροφή ιστού.
Αμινοτρανσφεράση Αλανίνης (ALT, παλιότερα λεγόταν SGPT)	4-36U/L	Συνήθως ελέγχεται για να αποτιμηθεί η ηπατική βλάβη. Αυξάνεται στις περισσότερες ηπατικές ασθένειες. Τα επίπεδά της είναι μερικώς αυξημένα μετά από καταστροφή ιστού.
Ηλεκτρολύτες Ορού		
Νάτριο	136-145 mEq/L	Βοηθά στην αξιολόγηση του επιπέδου ενυδάτωσης του ατόμου ή τις νευρομυικές, νεφρικές και τις επινεφριδιακές λειτουργίες
Κάλιο	3,5-5,5 mEq/L	Βοηθά στην αξιολόγηση οξειοβασικής ισορροπίας και της λειτουργίας των νεφρών. Μπορεί να ανιχνεύσει ανισσοροπίες στο κάλιο
Χλώριο	95-105 mEq/L	Βοηθά στην αξιολόγηση του επιπέδου ενυδάτωσης του ατόμου και ανιχνεύει ηλεκτρολυτικές και οξειοβασικές ανισσοροπίες
Άλλα		
Γλυκόζη	70-110mg/dL	Ανιχνεύει τον κίνδυνο ανοχής στην γλυκόζη, Σακχαρώδη Διαβήτη και υπογλυκαιμία. Βοηθά στην παρακολούθηση της θεραπείας του διαβήτη.
Γλυκοζυλιωμένη Αιμοσφαιρίνη (HbA_{1c})	3,9-5,2%	Χρησιμοποιείται για τον έλεγχο της γλυκόζης αίματος σε μακροχρόνια βάση (κατά μέσο όρο για τις προηγούμενες 120 μέρες)
Άζωτο Ουρίας Αίματος (BUN)	8-18 mg/dL	Κυρίως χρησιμοποιείται για την παρακολούθηση της νεφρικής λειτουργίας. Η αξία του διαφοροποιείται σε νεφρική ανεπάρκεια, αφυδάτωση ή κατάσταση shock.
Ουρικό Οξύ	2,8-8,8 mg/dL (γυναίκες) 4,0-9,0 mg/dL (άνδρες)	Χρησιμοποιείται για να ανιχνεύσει την ουρική αρθρίτιδα ή αλλαγές στη νεφρική λειτουργία. Τα επίπεδα επηρεάζονται από την ηλικία και τη διατροφή. Η τιμή του ποικίλει μεταξύ των διαφορετικών φυλών των ανθρώπων.
Κρεατινίνη (ορού ή πλάσματος)	0,6-1,2 mg/dL	Χρησιμοποιείται για την παρακολούθηση της νεφρικής λειτουργίας.

Πηγή: Nelms MN, Roth SL & Lacey K. Medical Nutrition Therapy. A Case Study Approach (3rd Edition). Belmont: Wadsworth, Cengage Learning, 2009. p. 421-422.

Ακολουθεί άλλος πίνακας με τους εργαστηριακούς δείκτες (με τιμές που αφορούν μόνο ενήλικο πληθυσμό), στον οποίο μπορούμε να δούμε και άλλα στοιχεία για αυτούς, όπως είναι το όργανο σύνθεση ή η προέλευσή τους, πιθανές διαφοροποιήσεις στις αναμενόμενες τιμές ανάλογα με την ηλικία, καθώς και καταστάσεις που ενδεχομένως μπορούμε να συναντήσουμε την κάθε εργαστηριακή μεταβλητή αυξημένη ή μειωμένη.

SELECTED LABORATORY VALUES FOR ADULTS*		
Test	**Normal values**	**Some implications**
Albumin – Serum ALB	3.5 - 5.0 g/dl (35-50 g/L SI units) >60 years 3.4-4.8 g/dl (34-48 g/L SI units)	**Function:** Maintain colloidal osmotic pressure; transport molecule for enzymes, fatty acids, hormones, bilirubin, and some drugs. **Site of synthesis:** Liver **Half Life:** 12-18 days **Increased:** Dehydration; also diarrhea, Hodgkin's disease, , metastatic carcinomatosis, non-Hodgkin's lymphoma, ulcerative colitis, uremia, and vomiting. **Decreased:** Overhydration; also acute infection and chronic inflammation, alcohol abuse, ascites, beriberi, burns, cholecystitis, CHF, cirrhosis, Crohn's, Cushing's, cystic fibrosis, dementia, diabetes mellitus, essential HTN, liver disease, leukemia, lymphoma, malabsorption syndrome, malnutrition, meningitis, myasthenia, myeloma, MI, neoplasms, nephrotic syndrome, nephrosis, osteomyelitis, peptic ulcer, pneumonia, pregnancy, protein losing enteropathies and protein losing nephropathies, rheumatic fever, rheumatoid arthritis, sarcoidosis, scleroderma, sprue, steatorrhea, stress, surgery, systemic lupus erythematosus, thyrotoxicosis, trauma, tuberculosis and ulcerative bowel disease.
Alkaline phosphatase Serum ALP	30 - 120 Units/L 0.5-2.0 µKat/L Elderly: slightly higher	**Function:** Enzyme found in bone, liver, biliary tract, intestine, and placenta; it rises during periods of bone formation/reparation or hepatic disease. **Site of synthesis:** Liver **Increased:** Alcohol abuse, amyloidosis, biliary obstruction, cholelithiasis in sickle cell disease, cirrhosis, cytomegalovirus, diabetes mellitus, excessive carbohydrate ingestion (large amounts), Fanconi syndrome, dysplasia, healing fracture, histiocytosis, Hodgkin's, hyperalimentation, hyperparathyroidism (with Paget's disease), hyperthyroidism, hypophosphatemia, intestinal infarction or ischemia, kidney rejection, liver abscess, cancer or disease, lung cancer, lymphoma, metastatic cancer to the bone, mononucleosis (infectious), myeloma, MI, osteosarcoma, primary or metastatic liver tumor, pulmonary or renal infarction, recent meal ingestion, rheumatoid arthritis, rickets, sarcoidosis, sickle cell crisis, ulcerative colitis. **Decreased:** Blood transfusions (massive), Burnett's syndrome, celiac disease, cretinism, excessive Vitamin D, excessive Vitamin B, hypophosphatasia, hypothyroidism, malnutrition, pernicious anemia, placental insufficiency, nephritis, scurvy, zinc deficiency.
Blood Urea Nitrogen BUN	10-20 mg/dl 3.6-7.1 mmol/L (SI Units) >60 years: 8-21mg/dl 2.9-7.5mmol/L (SI Units)	**Function:** End product of protein metabolism converted in the liver to form urea. **Site of synthesis:** Liver **Increased:** Addison's disease, allergic purpura, amyloidosis, anabolic steroid use, analgesic abuse, blood transfusions, burns, cachexia, cardiac failure, congenital hypoplastic kidneys, CHF, dehydration, DM with diabetic ketoacidosis, Fanconi syndrome, excessive fluids, excessive protein intake, GI bleed, glomerulonephritis, Goodpasture's syndrome, gout, heavy-metal poisoning, hemoglobinurias, hypovolemia, infection, intestinal obstruction, MI, nephritis, nephropathy, nephrosclerosis, nephrotoxic drugs, pancreatitis, peritonitis, pneumonia, polyarteritis nodosa, polycystic disease, post-surgical state, pregnancy, protein catabolism, pyelonephritis, renal arterial stenosis or thrombosis, renal insufficiency or failure, scleroderma, sepsis, shock, sickle cell anemia, starvation, stress, subacute bacterial endocarditits, suppuration, systemic lupus erythematosus, thyrotoxicosis, tumor necrosis, uremia and urinary tract obstruction. **Decreased:** Acromegaly, alcohol abuse, amyloidosis, celiac, cirrhosis, hemodialysis, hepatitis, insufficient protein intake, overhydration, liver damage or failure, malabsorption, malnutrition, nephrotic syndrome, pregnancy (advanced), and syndrome of inappropriate antidiuretic hormone.

Test	Normal values	Some implications (...continued)
Calcium, Serum Ca Calcium, Ionized Serum	8.2-10.7 mg/dl 2.1-2.7 mmol/L (SI units) <u>>60 yrs:</u> 8.8-10.2 mg/dL 2.2-2.5 mmol/L (SI units) <u>>90 yrs:</u> 8.2-9.6 mg/dl 2.05-2.4 mmol/L (SI units) 4.45-5.3 mg/dl 1.1-1.3 mmol/L (SI units)	**Function:** Cation responsible for bone formation, nerve transmission, contraction of cardiac and skeletal muscle and in the conversion of prothrombin to thrombin in blood clotting. Ionized calcium is unaffected by changes in albumin and reflects bioavailable pool. **Site of synthesis:** N/A **Increased:** Acidosis (respiratory), acromegaly, acute tubular necrosis, Addison's disease, bacteremia, berylliosis, Burnett's syndrome, coccidiomycosis, ectopic neoplasms, endocrine neoplasia ,excessive milk ingestion, familial hypocalciuric hypercalcemia, hepatic disease (chronic end stage), high calcium intake, histoplasmosis, hyperparathyroidism, hyperthyroidism, hypervitaminosis (excessive vitamin D or A), prolonged immobility, leukemia, lymphoma, malignancy, metastatic bone cancer, multiple myeloma, mycoses, osteoporosis, Paget's disease, pheochromocytoma, polycythemia vera, porphyria, renal calculi or osteomalacia (aluminum induced), renal transplantation, respiratory disease, rhabdomyolysis, sarcoidosis, and tuberculosis. **Decreased:** Alkalosis, bacteremia, blood transfusions (without calcium replacement), burns, cachexia, celiac, chronic renal disease, CF of pancreas, diarrhea, Fanconi syndrome, hypomagnesemia, hypoparathyroidism, hypoalbuminemia (drops 0.8 for every 1 gm/dL drop in albumin), infection, malabsorption, malaria, milkman syndrome, nephritis, nephrosis, nephrotic syndrome, obstructive jaundice, osteomalacia, pancreatitis, parathyroidectomy, pregnancy (late), pseudohypoparathyroidism, renal insufficiency or failure, renal tubular acidosis, rickets, sprue, starvation, toxic shock syndrome, thyroidectomy with removal of parathyroid gland and vitamin D deficiency.
Chloride – Blood/Serum Cl	98-106 mEq/L 98-106 mmol/L (SI units)	**Function:** Maintain electrical neutrality, body fluid, and acid/base balance. **Site of synthesis:** N/A **Increased:** Acidosis (metabolic and nephrotic), acute renal failure, alcohol abuse, alkalosis (respiratory), anemia, bromism, CHF, Cushing's, dehydration, diabetes insipidus, diarrhea, eclampsia, excessive normal saline administration, fever, trauma to head, hyperaldosteronism, hypercorticoadrenalism, hypernatremia, hyperparathyroidism, hyperventilation, hypoproteinemia, intestinal fistula, kidney dysfunction, multiple myeloma, nephritis, nephrosis, ostomies, prostatic obstruction, salicylate toxicity, seawater aspiration, serum sickness, uremia and urinary obstruction. **Decreased:** Acidosis (DKA, lactic, metabolic, renal, respiratory-chronic), Addison's,, amyotrophic lateral sclerosis, anesthesia, burns, CNS disorder, chronic diarrhea, CHF, edema, emphysema, fasting, fever, freshwater aspiration, gastric suctioning, heat exhaustion, heavy-metal poisoning, hypertrophic pyloric stenosis, hypokalemia, hyponatremia, hypoventilation, infection, intestinal obstruction, nephritis (salt-wasting), overhydration, paralytic ileus, pneumonia, pyelonephritis, pyloric obstruction, renal failure, rickets, syndrome of inappropriate antidiuretic hormone, typhoid, ulcerative colitis, uremia, vomiting, Waterhouse-Friderichsen syndrome and water intoxication.
Cholesterol - Blood Total Chol	< 200 mg/dl < 5.2 mmol/L (SI units) 200-239 mg/dl Borderline high >239 mg/dl High	**Function:** Used to form bile acids and hormones; component of brain and nerve cells and cell membranes throughout the body. **Site of synthesis:** Liver and intestines **Increased:** Aplastic anemia, anorexia nervosa, atherosclerosis, bile duct obstruction, biliary cirrhosis, carbon disulfide exposure (textile workers), CHD, CHF, celiac, cholestasis, Cushing's, DM (uncontrolled), excessive cholesterol, saturated or trans fat consumption, Forbes' disease, glycogen storage diseases, H. pylori, hypercholesterolemia, hyperlipidemia, hyperlipoproteinemia, hypertension, hypothyroidism, jaundice, leukemia, lipoidosis, MI, nephrosis, nephrotic syndrome, obesity, oophrectomy, pancreatectomy, pancreatitis (chronic), pregnancy, smoking, stress, and xanthomatosis, **Decreased:** Acanthocytosis, amylopectinosis, Andersen's disease, anemia (hemolytic or pernicious), Bassen-Kornzweig syndrome, brancher deficiency, cancer, cholesterol lowering drugs, chromium enhanced diet, cirrhosis, depression, epilepsy, absent cholesterol esters, gastric bypass surgery, Gaucher's disease, Hansen's disease, hepatic disease, hepatitis, hyperthyroidism, hypolipoproteinemias (Abeta and hypobeta), infections(severe), intestinal obstruction, jaundice, leprosy, liver necrosis, malnutrition, MI (up to 90 days), pancreatic carcinoma, porphyria, premenstrual time phase, steatorrhea, suicidal behavior, Tangier disease, TB, glycogen deposition diseases, and uremia.

Test	**Normal values**	**Some implications** (...continued)
High density Lipoprotein – Blood HDL	Male: 30-65 mg/dl or 0.8 -1.7 mmol/L (SI units) Goal: >45mg/dl Female: 35-85 mg/dl or 0.91-2.2 mmol/L (SI units) Goal:>55 mg/dl Adult Ideal: >60 mg/dl	**Function:** Carries cholesterol from tissues and transports it to the liver for catabolism and excretion. **Site of synthesis:** Liver and intestines **Increased:** Alcoholism, chronic hepatitis, familial HDL lipoproteinemia, hypothyroidism, increased exercise and primary biliary cirrhosis. **Decreased:** Alcohol intake, arteriosclerosis, bacterial and viral infections, cholestasis, CHD, excessive carbohydrate intake, hypercholesterolemia, hypertriglyceridemia, hypolipoproteinemia (type IV), insufficient exercise, liver disease (hepatitis or cirrhosis), malnutrition, metabolic syndrome, nephrotic syndrome, obesity, polycystic ovary syndrome, renal disease, Tangier disease, smoking, uncontrolled DM, up to 90 days post MI.
Low density lipoproteins – Blood LDL	60-180 mg/dl or <3.37 mmol/L (SI units) Ideal: <100 mg/dl 2.59 mmol/L (SI units) Near optimal: 100-129mg/dl Optimal: 130-159 mg/dl High: 160-189 mg/dl Very High: 190 or above	**Function:** Carries cholesterol and triglycerides to peripheral tissues. **Site of synthesis:** Liver **Increased:** Acute MI, alcohol intake, anorexia nervosa, apoprotein CII deficiency, chronic anemias, chronic hepatitis or cirrhosis, coronary atherosclerosis, Cushing's, DM, dysglobulinemias, eclampsia, excessive cholesterol ,saturated or trans fat consumption, familial hypolipoproteinemias, glycogen storage diseases (von Gierke's), hepatoma, hypercholesterolemia (type IIa), hyperlipidemia, hypothyroidism, Laennec's cirrhosis, multiple myeloma, nephrotic syndrome, obesity, porphyria, pregnancy and renal failure. **Decreased:** Arteriosclerosis, abetalipoproteinemia, COPD, hyperlipoproteinemia (type I), hyperthyroidism, hypoalbuminemia, inflammatory joint disease, malabsorption, malnutrition, multiple myeloma, lung disease, Reye's syndrome, severe burns, stress, and Tangier disease.
Creatinine Serum	Male: 0.6 - 1.2 mg/dl 53-106 µmol/L (SI units) Female: 0.5 - 1.1 mg/dl 44 - 97 µmol/L (SI units)	**Function:** Nitrogenous by-product in the breakdown of muscle creatine phosphate for energy metabolism. **Site of synthesis:** N/A **Increased:** Acromegaly, allergic purpura, amyloidosis, analgesic abuse, azotemia, congenital hypoplastic kidneys, CHF, DM, dehydration, high meat intake, gigantism, glomerulonephritis, Goodpasture's syndrome, gout, hemoglobinuria, high dietary intake, hypovolemic shock, hypothyroidism, intestinal obstruction, Kimmelstiel-Wilson syndrome, micro albuminemia, metal poisoning, multiple myeloma, muscle destruction, nephritis, nephropathy, nephrosclerosis, nephro-toxic drugs, pancreatitis (necrotizing), polyarteritis nodosa, polycystic disease, preeclampsia, pyelonephritis, renal artery stenosis or thrombosis, renal failure, rhabdomyolosis, rheumatoid arthritis, scleroderma, sickle cell anemia, subacute bacterial endocarditis, systemic lupus erythematosus, testosterone therapy, toxic shock, uremia, urinary obstruction and vomiting. **Decreased:** DKA (artifactual), overhydration, muscular dystrophy, myasthenia gravis, severe muscle wasting.

Test	**Normal values**	**Some implications** (...continued)
Gamma - glutamyl transferase or GGT Gamma - glutamyl transpeptidase GGTP	> 45 yrs: 8-38 units/L : 8-38 International Units/L (SI units)	**Function:** Transfer of amino acids and peptides into cells across cell membranes and involved in glutathione metabolism **Site of synthesis:** The liver is the source of this biliary excretory enzyme, but it is also found in the kidneys, pancreas, brain, heart, salivary and prostate glands. **Increased:** Acetaminophen toxicity, acute MI (7-14 days post), alcoholism, biliary atresia, cholecystitis (due to biliary obstruction), cholestasis, cirrhosis, CHF, Epstein-Barr, excessive meat consumption, fatty liver, hepatitis, liver tumor or bile duct metastasis, hepato-toxic drugs, jaundice (obstructive), Kawasaki disease, lipoid nephrosis, metabolic syndrome, mononucleosis like syndrome, nephrotic syndrome, obesity (extreme), pancreatitis (acute), pancreatic or renal carcinoma, parenteral nutrition (long term associated with cholestasis),Reye's syndrome, and systemic lupus erythematosus. **Decreased:** Improving cardiovascular risk factors and late pregnancy.
Glycosylated Hemoglobin – Blood Hgb A1C	4-5.9% (nondiabetic) good 6-6.9% fair 7-8.9% poor >9%	**Function:** The predominant glucose bonded hemoglobin (others are A1A, A1B) within the red blood cells during their circulating lifespan **Site of synthesis:** Circulating glucose binds to hemoglobin in the bloodstream **Increased:** Acromegaly, cortocosteroid treatment, fetal-maternal transfusion, hemodialysis, hemoglobinopathies, inadequate blood glucose control 2-4 months prior, newly diagnosed diabetes, non-diabetic hyperglycemia, pregnancy, splenectomy. **Decreased:** Low RBC (chronic blood loss), chronic renal failure, hemolytic or pernicious anemia, , sickle cell anemia, splenectomy, thalassemias, acromegaly, vitamin E supplementation, pregnancy
Glucose- Plasma	Male: 40-54% 0.40-0.54 volume fraction (SI units) Female: 37-47% 0.37-0.47 volume fraction (SI units) Elderly: slight decrease	**Function:** Percent of packed red cells in volume of whole blood **Site of synthesis:** Red blood cells are produced in stem cells of the bone marrow. **Increased:** Addison's disease, blood transfusions to increase athletic performance (doping), burns (severe), dehydration (severe), COPD, congenital heart disease, DM, diarrhea, eclampsia, erythrocytosis, hemorrhage (blood loss), hemoconcentration, high altitudes, pancreatitis (acute), polycythemia, shock, surgery, and tetralogy of Fallot. **Decreased:** Anemia (hemolytic), bone marrow hyperplasia, burns (severe), cirrhosis, CHF, CF, dietary deficiency, fatty liver, fluid overload, hemolytic reaction, hemorrhage, hyperthyroidism, hypothyroidism, idiopathic steatorrhea, intestinal obstruction (late), leukemia, malnutrition, multiple myeloma, overhydration, pancreatitis (hemorrhagic), pneumonia, pregnancy, and rheumatoid arthritis.
Hemoglobin – Blood Hgb	Male: 13.6 - 18 g/dl 8.4-11.2 mmol/L (SI units) Female: 12 - 16 g/dl 7.4-9.9 mmol/L (SI units)	**Function:** Oxygen and carbon dioxide transport, acid / base balance along with Cl **Site of synthesis:** Main component of red blood cells produced in the stem cells of the bone marrow. **Increased:** Burns (severe), CHF, COPD, congenital heart disease, dehydration, diarrhea, erythrocytosis, hemorrhage, hemoconcentration, high altitudes, intestinal obstruction (late), polycythemia vera, snorers (chronic hypoxia), and thrombotic thrombocytopenic purpura. **Decreased:** Andersen's disease, anemia (iron , megaloblastic, or pernicious), carcinomatosis, cirrhosis, CF, fat emboli, fatty liver, fluid retention, hemorrhage, hemolysis, hemolytic reaction, Hodgkin's disease, hyperthyroidism, hypervitaminosis A, hypothyroidism, idiopathic steatorrhea, intravenous overload, kidney disease, leukemia, lymphoma, malnutrition, neoplasia, overhydration, platelet apheresis, pregnancy, renal cortical necrosis, sarcoidosis, severe hemorrhage, Sickle cell anemia, splenomegaly, systemic lupus erythematosus, tetralogy of Fallot, and transfusion of incompatible blood.

Test	Normal values	Some implications (...continued)
Iron- Serum Fe	Male: 50 – 160 mcg/dl 8.9-28.7µmol/L (SI units) Female: 40 – 150 mcg/dL 7.2-26.9µmol/L (SI units)	**Function:** Aids in the transport of O2 by hemoglobin and indirectly in return of CO2 to the lungs **Site of synthesis:** primary source is ingestion through diet **Increased:** Alcohol ingestion, anemias (aplastic, hemolytic, pernicious, sideroblastic), blood transfusion, folic acid deficiency, hemochromatosis, hemosiderosis, hepatic necrosis, hepatitis, high iron intake, iron toxicity, lead poisoning, nephritis, polycythemia, and thalassemia.. **Decreased:** Blood loss (chronic and GI), burns, carcinoma, gastrectomy, heavy menstruation, infection, insufficient dietary iron, iron deficiency anemia, kwashiorkor, malabsorption of iron, neoplasia, nephrosis, post-operative state, pregnancy (late), rheumatoid arthritis, schizophrenia (chronic), tetralogy of Fallot, and uremia.
Mean Corpuscular Hemoglobin – Blood MCH	27-31 pg/cell	**Function:** Measure of the average weight of hemoglobin in a red blood cell **Site of synthesis:** RBCs are produced in the stem cells of the bone marrow **Increased:** Anemia (macrocytic, pernicious), cold agglutinin conditions, cigarette smokers, dysproteinemia, infants, newborns, and presence of monoclonal blood proteins. **Decreased:** Anemia (iron deficiency, microcytic, normocytic), cyanotic congenital heart disease.
Mean Corpuscular Hemoglobin Concentration – Blood MCHC	32 - 36 g/dl or %	**Function:** Measures the average concentration of hemoglobin in red blood cells **Site of synthesis:** RBCs are produced in the stem cells of the bone marrow **Increased:** High titer of cold agglutinins, dehydrated hereditary stomatocytosis, hereditary spherocytosis, intravascular hemolysis, lipemia, and obesity. **Decreased:**Aluminum intoxication, anemias (iron deficiency, chronic, hypochromic, megaloblastic, microcytic, sideroblastic), benzene exposure, colorectal cancer, and thalassemia.
Mean Corpuscular Volume – Blood MCV	80 – 95 µm3	**Function:** Measure of individual red blood cell size: microcytic: <87, macrocytic: >103 **Site of synthesis:** RBCs are produced in the stem cells of the bone marrow **Increased:** Alcoholism (chronic), anemia (acquired hemolytic, aplastic, immune hemolytic, macrocytic induced by megaloblastic anemias, pernicious [early]), benzene exposure, cigarette smokers, cirrhosis, chronic lymphocytic leukemia, cytomegalovirus, DKA, DM, DNA synthesis disorders, folate deficiency, gastrectomy, hepatic disease, hyperthyroidism, ileal resection, leukocytosis, methanol poisoning, obesity, pancreatitis, PAD, preleukemia, reticulocytosis, celiac sprue, and vitamin B12 deficiency. **Decreased:** Anemia (of chronic disease, dyserythropoietic, hypochromic, iron deficiency, microcytic, pyridoxine responsive, sickle cell), Brunner's gland hamartoma, chlorosis, chronic disease colorectal cancer, diverticulitis, diverticulosis, endocarditis, G6PD deficiency, gangrene, hemoglobin E, hemoglobin H, lead poisoning, leukocytosis, malaria, myocarditis, nephropathy, pruritus, radiation therapy, red blood cell fragmentation, subacute bacterial endocarditis, thalassemia, and warm auto antibodies.

Test	Normal values	Some implications (...continued)
Parathyroid Hormone- intact Serum PTH	10-65 pg/ml 10-65 ng/L (SI units) Increases in aging.	**Function:** Regulation of calcium and phosphorus homeostasis; causes calcium release from the bones and increases calcium and decreases phosphorus reabsorption in renal tubules. **Site of synthesis:** Parathyroid gland **Increased:** CRF, ectopic PTH production, hypocalcemia, lactation, osteomalacia, parathyroid adenoma, parathyroid carcinoma, parathyroid hyperplasia, pregnancy, primary hyperparathyroidism, renal hypercalciuria, rickets, secondary hyperparathyroidism, squamous cell carcinoma (kidney, lung, pancreas), vitamin D deficiency. **Decreased:** autoimmune disease, cancer, Graves' disease, hypomagnesemia, hypoparathyroidism, hypercalcemia, parathyroidectomy (transient), sarcoidosis, and vitamin A or vitamin D toxicity.
Potassium – Serum K	3.5 - 5.0 mEq/L 3.5-5.0 mmol/L (SI units)	**Function:** Electrical conduction in muscle cells, acid / base balance, and cellular water balance. **Site of synthesis:** Ingested through diet and located in the intracellular fluid of the cells **Increased:** Acidosis (keto-, metabolic), Addison's, adrenocortical insufficiency, anemia (hemolytic), anxiety, asthma, burns, dehydration, dialysis, excessive K in diet or IV , dysrhythmia, hemolysis, hypoventilation, elevated osmolality, infection, leukocytosis, malignant hyperthermia, massive rapid RBCl transfusion, muscle necrosis, near-drowning, obstruction (intestinal), ostomies, pneumonia, pseudohypoaldosteronism, renal failure, renal HTN, sepsis, shock, status epilepticus, SIADHS, thrombocytosis, tissue trauma, uremia and Waterhouse-Friderichsen syndrome. **Decreased:** Acute tubular necrosis, alcoholism, aldosteronism, alkalosis, anorexia, barium intoxication, Bartter syndrome, bradycardia, burns, colon cancer, CP, cholera, cirrhosis, CHF, Crohn's, crushed tissue trauma, Cushing's, dehydration, diabetes insipidus, DM, diarrhea, diuretics, dumping syndrome, dysrhythmias, Fanconi syndrome, fever, fistulas, folic acid deficiency, gastric suction, hyper aldosteronism, hyperalimentation, hypercorticoadrenalism, HTN, hypomagnesemia, hypothermia, hypovolemia, hysterectomy, insufficient K in diet or IV, insulin or glucose administration, kwashiorkor, ketoacidosis, laxative abuse, licorice ingestion, lymphoma, malabsorption, malignant hyperthermia, metabolic alkalosis, nephritis, organic brain syndrome, ostomies, pancreatitis, paralytic ileus, pseudoaldosteronism, pyelonephritis, pyloric obstruction, renal tubular acidosis, salicylate toxicity, salt-losing nephropathy, post sigmoidoscopy, sweating, surgery (post-op), starvation, stress, toxic shock, syndrome, ureterosigmoidostomy, villous adenoma, VIPoma (a type of watery diarrhea), vomiting, , and Zollinger-Ellison syndrome (with diarrhea).
Prealbumin – Serum PAB	15-36 mg/dl 150-360 mg/L (SI units)	**Function:** Transport protein that carries thyroxine, and retinol in the body. **Site of synthesis:** Liver Half-Life: 2-4 days **Increased:** Adrenal hyperfunction, CKD, dehydration, Hodgkin's disease, nephrotic syndrome, pregnancy, shigellosis. **Decreased:** Abdominal peritoneal dialysis, burns, cirrhosis, chronic illness (with concomitant subnormal nutritional status), CF, DM, disseminated malignant disease, epithelial ovarian carcinoma, hereditary amyloidosis, infection, inflammation, liver damage, overhydration, protein and calorie malnutrition, salicylate poisoning.

Test	**Normal values**	**Some implications** (...continued)
Prothrombin Time – PT	11 – 12.5 seconds	**Function:** Vitamin K dependent clotting time of blood **Site of synthesis:** N/A **Increased:** Alcoholism, blood transfusion (massive), cancer, celiac disease (same thing as sprue – omitted below), chronic diarrhea, circulating anticoagulants, colitis, collagen disease, CHF, factor deficiency (hereditary), fibrinogenemias (a-, dis-, hypo), fever, fistula, hepatic damage (abscess, cirrhosis, biliary obstruction, failure, jaundice, infectious, hepatitis) hypernephroma, hyperthyroidism, hypervitaminosis A, hypoprothrombinemia, leukemia, malabsorption, malnutrition, myelofibrosis, obstetric complications, pancreatic carcinoma, pancreatitis (chronic), polycythemia vera, prolonged hot weather, PT deficiency, Reye's syndrome, salicylate intoxication, snakebite, steatorrhea, toxic shock, vitamin K deficiency and vomiting. **Decreased:** Arterial occlusion, DVT, edema, coumarin resistance, high fat diet, hyperlipidemia, hyperthyroidism, hypothyroidism, multiple myeloma, MI, peripheral vascular disease, pulmonary embolism, spinal cord injury, thromboembolism, transplant rejection.
Sodium – Plasma Na	136 - 145 mEq/L 136-145 mmol/L (SI units)	**Function:** Conduct nerve impulses, maintain osmotic pressure, and acid / base balance. **Site of synthesis:** Source is dietary intake. **Increased:** CHF, Cushing's, dehydration, diabetes insipidus, diaphoresis, diarrhea, hyperaldosteronism, HTN, hypovolemia, insensible water loss, ostomies salicylate toxicity, toxemia, vomiting, Zollinger-Ellison syndrome with diarrhea. **Decreased:** Addison's disease, adrenal insufficiency, aminoglycoside toxicity, ascites, bowel obstruction, burns, CP, CRF, cirrhosis, congenital adrenal hyperplasia, DM, emphysema, glomerulonephritis, hyperglycemia, hyperosmolality, hyperthermia, hypophosphatemia, hypotension, hypothyroidism, hysterectomy, malabsorption, malnutrition, meningitis, metabolic acidosis, myxedema, nephrotic syndrome, ostomies, overhydration, pain (abdominal), paracentesis, paralytic ileus, psychogenic polydipsia, pyelonephritis (chronic), renal HTN, sigmoidoscopy, sprue, SIADHS, toxemia, toxic shock syndrome, and vomiting.
Specific gravity of urine	1.005-1.030	**Function:** Ratio of the density of urine compared to the density of an equal volume of water (1.000). **Increased:** Adrenal insufficiency, bacteruria, CHF, dehydration, DM, diarrhea, fever, glomerulonephritis, obstruction uropathy, proteinuria, SIADHS, toxemia of pregnancy, and vomiting. **Decreased:** Chronic renal insufficiency, diabetes insipidus, hypothermia, intracranial pressure increase, malignant hypertension and overhydration.
Total lymphocyte count (TLC)	2500 - 3300 cells/mm^3 2500-3300 x 10^6	**Function:** Fight infection and fight against foreign bodies (both bacterial and viral). **Site of synthesis:** Bone marrow stem cells **Increased:** Chronic bacterial infection, infectious hepatitis, infectious mononucleosis, lymphocytosis, lymphocytic leukemia, multiple myeloma, mumps, rubella, and radiation. **Decreased:** Adenocorticosteroid therapy, antineoplastic therapy, HIV (late stage), immunodeficiency diseases, leukemia, lymphocytopenia, radiation therapy, sepsis, systemic lupus erythematosus. cancer, chemotherapy, radiotherapy, surgery, lymphopenia, malnutrition, AIDS, bone marrow failure, Cushing's syndrome, renal failure

Test	**Normal values**	**Some implications** (...continued)
Transferrin	Males: 215 - 365 mg/dl 2.15-3.65 g/L (SI units) Females: 250-380 mg/L 2.5-3.8 g/L (SI units)	**Function:** Largest quantity of iron binding proteins for transporting iron **Site of synthesis:** Liver **Half-Life:** 9 days **Increased:** Hepatitis, microcytic anemia (Fe deficient), oral contraceptives, polycythemia, pregnancy (late). **Decreased:** Anemia (hemolytic, pernicious, and sickle cell), cirrhosis, corticosteroid therapy, dysmenorrheal, hemochromatosis, hemorrhage, hepatitis, hypoproteinemia, hypothyroidism, inflammatory diseases, kwashiorkor, microcytic anemia, MI, neoplasm, nephrosis, thalassemia, and uremia.
Triiodothyronine - Blood T_3	20-50 yr 70-205 ng/dl 1.2-3.4 nmol/L (SI units) >50 yr 40-180 ng/dl 0.6-2.8 nmol/L (SI units)	**Function:** Thyroid hormone found in small quantities bound to serum proteins in the blood **Site of synthesis:** Thyroid (as stimulated by TSH from pituitary) and liver (conversion of T4) **Increased:** Graves' disease, hepatitis, hyperthyroidism (factitious), hyperproteinemia, increased TBG (factitious), Plummer's disease, struma ovarii, pregnancy, thyroiditis (acute), and toxic thyroid adenoma. **Decreased:** Cirrhosis, cretinism, Cushing's, endocrine secreting tumors, hepatitis (acute), hypothalamic failure, hypothyroidism, increased TBG, iodine insufficiency, liver disease, malnutrition (protein), myxedema, nephrotic syndrome, pituitary insufficiency, pregnancy, renal disease, and surgical thyroid ablation.
Thyroxine – Blood T_4	Males: 4-12 mcg/dl 51-154 nmol/L (SI units) Females: 5-12 mcg/dl 64-154 nmol/L (SI units) Adult >60: 5-11 mcg/dL 64-142 nmol/L (SI units)	**Function:** Primary component of thyroid hormone bound to serum proteins in the blood **Site of synthesis:** Thyroid (as stimulated by TSH released from pituitary gland) **Increased:** Graves' disease, hepatitis, hyperproteinemia (congenital), hyperthyroidism (factitious), byperthyroxinemia (familial dysalbuminemic), increase TBG (factitious), Plummer's disease, post-radiographic iodinated contrast studies, oral contraceptives, pregnancy,struma ovarii, thyroiditis (acute), and toxic thyroid adenoma **Decreased:** Cirrhosis, cretinism, Cushing's, hypothalamic failure, iodine deficiency, myxedema, pituitary insufficiency, protein depletion or wasting diseases, renal failure, and surgical ablation.

Test	**Normal values**	**Some implications** (...continued)
Triglycerides – Blood TG	Male: 40-160 mg/dl, 0.45-1.81 mmol/L (SI units) Female: 35-135 mg/dl, 0.4-1.52 mmol/L (SI units) *Borderline High:* 150-199 mg/dL, 1.7- 2.25 mmol/L *High:* 200-499 mg/dL; 2.26-5.64 mmol/L *Very High:* > 500 mg/dL, > 5.65 mmol/L	**Function:** Fat within the bloodstream (primarily VLDL with <10% LDL) stored as an energy source in fatty tissues. High triglycerides (> 400 mg/dl) may make LDL unreadable/ unreliable. **Site of synthesis:** Liver **Increased:** Alcoholism, aortic aneurysm, aortitis, arteriosclerosis, DM (poorly controlled), familial hypertriglyceridemia, fat embolism, glycogen storage diseases, gout, hepatic cholesterol ester storage disease, high CHO and prolonged high fat intake, hypercholesterolemia, hyperlipoproteinemia, hypothyroidism, metabolic syndrome (>150 mg/dl), MI (up to 1 year post), myxedema, nephrotic syndrome, obesity, pancreatitis, pregnancy, renal insufficiency, starvation (early), stress, Tangier disease, tobacco use, and von Gierke's disease. **Decreased:** Abetalipoproteinemia, acanthocytosis, cirrhosis, COPD, hyperalimentation, hyperthyroidism, malabsorption, and malnutrition.
Uric Acid-Serum	Male: 4.0-8.5 mg/dL 0.24-0.51 mmol/L (SI units) Female: 2.7 – 7.3 mg/dL 0.16-0.43 mmol/L (SI units) Elderly: may be elevated	**Function:** RNA and DNA formation and degradation **Site of synthesis:** End product of purine catabolism **Increased:** Acidosis (ketotic or lactic), alcoholism, anemia (hemolytic, pernicious, sickle cell), arteriosclerosis, arthritis, berylliosis, Blackfoot Indians, body size (larger than average), calcinosis universalis and circumscripta, CHF, chemotherapy, CRD, dehydration, DM, down syndrome, eclampsia, exercise, fasting, Filipinos, generic inborn error in purine metabolism, glomerulonephritis (chronic), gout, Graves' disease, hemolysis (prolonged), hepatic disease, high protein intake, high purine diet, HTN, hyperlipoproteinemia, hyperuricemia, hypoparathyroidism, hypothyroidism, infections (acute), intestinal obstruction, ketoacidosis,ketosis, lead poisoning, Lesch-Nyhan syndrome, leukemia, lipoproteinemia (Type III), lymphoma, metastatic cancer, mononucleosis (infectious), multiple myeloma, neoplasm, nephritis, nephropathy, New Zealand Maoris, Pima Indians (Akimel O'odham), pneumonia (resolving), polycystic kidneys, polycythemia vera, pregnancy (labor onset), psoriasis, renal failure, rhabdomyolosis (burns, crush injury, MI, heavy exercise), sarcoidosis, starvation, stress, toxemia of pregnancy, uremia, urinary obstruction and von Gierke's disease. **Decreased:** Acromegaly, anemia (pernicious), bronchogenic carcinoma, celiac disease, Dalmation dog mutation, Fanconi syndrome, Hodgkin's disease, lead poisoning, myeloma, Wilson's disease, xanthinuria, xray contrast agents, and yellow atrophy of liver.

Test	**Normal values**	**Some implications** (...continued)
Vitamin D (Cholecalciferol) Serum vitamin D_3 (1,25-dihydroxy-) Plasma vitamin D_3 (25-hydroxy-) Summer Winter	 15-75 pg/ml 39-195 nmol/L (SI units) 15-80 ng/ml, 37-200 nmol/L (SI units) 14-42 ng/ml, 35-105 nmol/L	**Function:** Fat soluble vitamin synthesized from stored cholesterol in the body when body is exposed to sunlight or through dietary intake from fortified foods. Allows for adequate dietary calcium absorption for regulating skeletal calcium. **Site of synthesis:** Liver and kidneys **Increased:** Hyperparathyroidism, hypervitaminosis D and sarcoidosis. **Decreased:** Gastric bypass, hepatic failure, hypoparathyroidism, malabsorption, osteomalacia, pseudohypoparathyroidism, renal failure, renal osteodystrophy, and rickets.
White Blood Cells – Blood WBC	5,000-10,000 mm^3 5-10 x 10^9 (SI units)	**Function:** Fight infection, defend body against invasion by foreign organisms, produce, transport and distribute antibodies **Site of synthesis:** Bone marrow **Increased:** Abcess, actinomycosis, acute infection, amebiasis, Andersen's disease, anemia (acquired hemolytic), anorexia, anoxia, anthrax, appendicitis, blastomycosis, bronchitis, burns, chickenpox, cholecystitis, choledocholithiasis, cholera, cirrhosis, colon cancer, Crohn's, Cushing's, cytomegalovirus, dehydration, diphtheria, inflammation, leukemic neoplasma, physical activity, pregnancy (late/labor), RBC hemolysis, splenectomy, sepsis, stress, surgery, tissue necrosis, trauma or tissue injury after surgery. **Decreased:** AIDS, alcoholism, anemia (aplastic, pernicious), anorexia nervosa, arsenic poisoning, autoimmune disease, bone marrow depression/failure (congenital aplasia, myelofibrosis), cachexia, drug toxicity (Chloramphenicol), hematopoietic disease, hypersplenism, leukemia, lymphoma, radiation therapy, sepsis, shock, stomatitis, viral or severe bacterial infection, systemic lupus erythematosus and TB.
* Each laboratory may use different standards to establish normal values; therefore, figures may vary among different sources.		

Ακολουθεί ένας οδηγός εργαστηριακών δεικτών για την ανίχνευση και διάκριση των διατροφικών και άλλων αναιμιών.

Guide to Anemias

Laboratory Test	Normal Values	Iron Deficiency Anemia	Megaloblastic Anemia (Folate Deficiency)	Pernicious Anemia (B-12 Deficiency)	Anemia of Chronic Disease
Hgb (g/dL)					
Females	12-16	< 12	< 12	< 12	< 12
Males	14-18	< 14	< 14	< 4	< 14
Hct (%)					
Females	37-47	< 37	< 37	< 37	< 37
Males	42-52	< 42	< 42	< 42	< 42
MCV (μm^3)	80-95	< 80	> 95	> 95 or normal	Normal
Serum Fe (mcg/dL)	60-160	< 60	> 160	> 160	< 60
TIBC (mcg/dL)	250-460	> 460	Normal	Normal	< 250
Serum B-12 (pg/mL)	160-950	Normal	Decreased	Decreased	Normal
Folate (ng/mL)	5-25	Normal	< 5	> 25	Normal or decreased

Abbreviations: Hgb, hemoglobin; Hct, hematocrit; MCV, mean corpuscular volume; TIBC, total iron binding capacity.

Πηγή: Adapted with permission from Litchford MD. Practical Applications in Laboratory Assessment of Nutritional Status. Greensboro, NC:CASE Software; 2010. In: Piland C & Adams K, eds. Pocket Resource for Nutrition Assessment. Texas: Dietetic in Health Care Communities, a dietetic practice group of Academy of Nutrition and Dietetics, 2009. p 39-44.