## Personalized Health Strategies Based on Laboratory Results

### Strategy for Dyslipidemia

#### Dietary Approach:

 Mediterranean diet pattern

 Plant sterols/stanols (2g daily)  Soluble fiber (10-25g daily)

 Omega-3 fatty acids (2-4g EPA/DHA daily)  Limited saturated fat (<7% of calories)

 No trans fats

 Limited added sugars

#### Physical Activity:

 150+ minutes weekly moderate aerobic activity  2-3 sessions weekly resistance training

 Reducing sedentary time with movement breaks

#### Weight Management:

 Achieving and maintaining healthy BMI

 Focus on waist circumference (<40" men, <35" women)  Sustainable approach to weight loss if needed

#### Additional Lifestyle Factors:

 Smoking cessation  Limiting alcohol

 Stress management  Adequate sleep

#### Supplement Considerations:

 Plant sterols/stanols

 Red yeast rice (when recommended)  Berberine (when recommended)

 Omega-3 supplements

 Coenzyme Q10 for statin users

#### Monitoring:

 Regular lipid panels

 hs-CRP to assess inflammation

 Apolipoprotein testing when indicated

### Strategy for Hypertension

#### Dietary Approach:

 DASH diet pattern

 Sodium limitation (<2,300mg/day, ideally <1,500mg)  Adequate potassium (4,700mg/day)

 Limited alcohol

 Caffeine moderation

#### Physical Activity:

 Regular aerobic activity (30+ minutes daily)  Isometric handgrip exercises

 Consistency more important than intensity

#### Weight Management:

 5-10% weight loss can significantly reduce BP  Focusing on abdominal obesity

#### Additional Lifestyle Factors:

 Stress management (meditation, deep breathing)  Adequate sleep

 Smoking cessation

 Limited NSAIDs and decongestants

#### Supplement Considerations:

 Magnesium (when indicated)  CoQ10 (when indicated)

 Garlic extract

 Potassium (if dietary intake inadequate)

#### Monitoring:

 Home blood pressure monitoring

 Ambulatory monitoring when indicated  Regular professional measurement

Medication adjustment as needed

# COMPREHENSIVE PREVENTION STRATEGIES FOR LONGEVITY

## Personalized Nutrition Based on Biomarkers

### Low Inflammation Pattern

**Indicated by:** Elevated hs-CRP, ESR, pro-inflammatory cytokines, elevated ferritin

#### Food Emphasis:

 Fatty fish (salmon, sardines) 2-3 times weekly

 Colorful vegetables and fruits (8-10 servings daily)  Extra virgin olive oil as primary fat

 Nuts and seeds (1-2 ounces daily)

 Herbs and spices (turmeric, ginger, garlic)  Green tea

 Moderate dark chocolate (>70% cacao)

#### Food Limitation:

 Refined carbohydrates and added sugars  Processed meats

 Trans fats and industrial seed oils  Excessive saturated fat

 Alcohol

 Potential individual food sensitivities

#### Meal Timing:

 Consideration of time-restricted eating (12-16 hour fasting window)  Regular meal patterns

 Adequate time between dinner and sleep (3+ hours)

### Blood Sugar Regulation Pattern

**Indicated by:** Elevated fasting glucose, HbA1c, insulin, or HOMA-IR

#### Food Emphasis:

 Low glycemic load foods

 High fiber (35-50g daily if tolerated)

 Protein with each meal (emphasis on plant and lean sources)  Healthy fats with carbohydrates to slow absorption

 Vinegar before carbohydrate-containing meals

 Cinnamon, berberine, and other glucose-regulating foods

#### Food Limitation:

 Refined flours and sugars  Sweetened beverages

 Excessive fruit juice

 Ultra-processed foods

 Excessive portions of even healthy carbohydrates

#### Meal Timing:

 Consistency in meal timing  Post-meal physical activity

 Front-loading calories earlier in day

 Consideration of protein-first approach to meals

### Detoxification Support Pattern

**Indicated by:** Elevated heavy metals, environmental toxins, phase I/II enzyme dysfunction

#### Food Emphasis:

 Cruciferous vegetables daily (broccoli, cauliflower, kale)  Sulfur-rich foods (garlic, onions, eggs)

 Chlorophyll-rich foods

 Adequate clean protein (to supply amino acids for detoxification)  Berries and other high-antioxidant foods

 Adequate hydration (filtered water)

#### Food Limitation:

 High-mercury fish (shark, swordfish, king mackerel)

 Conventionally grown produce with high pesticide residue  Processed foods with additives and preservatives

 Artificial colors, flavors, and sweeteners

 Alcohol

#### Supportive Practices:

 Sweating through exercise or sauna  Regular bowel movements

 Consideration of periodic supported detoxification protocols  Environmental toxin reduction strategies

## Exercise Prescription Based on Biomarkers

### Cardiovascular Health Focus

**Indicated by:** Dyslipidemia, hypertension, elevated inflammatory markers, poor glucose control

#### Aerobic Activity:

 Moderate intensity: 150-300 minutes weekly

 High intensity interval training: 1-2 sessions weekly if appropriate  Daily movement rather than sedentary with occasional exercise

 Post-meal walking (especially after dinner)

#### Resistance Training:

 2-3 sessions weekly targeting major muscle groups  Focus on compound movements

 Progressive overload approach

 Intensity sufficient to stimulate muscle adaptation

#### Special Considerations:

 Heart rate monitoring for appropriate intensity

 Blood pressure monitoring for hypertensive individuals  Glucose monitoring before/after exercise for diabetics  Gradual progression for deconditioned individuals

**Horm# COMPREHENSIVE LABORATORY TESTS: DIAGNOSTIC REFERENCE GUIDE**

## Introduction

This comprehensive guide provides detailed information on laboratory tests used for medical diagnostics, disease prediction, detection, and prevention. Each section includes normal ranges, abnormal ranges, critical ranges, and personalized strategies for health improvement related to each test parameter.

The goal of this guide is to support:

 Accurate medical diagnostics  Early disease detection

 Effective health monitoring

 Personalized prevention strategies

 Optimized health outcomes and increased lifespan

## How to Use This Guide

This document is organized by body system, with detailed information for each laboratory test including:

1. Normal, abnormal, and critical reference ranges
2. Which body organ, part, or function the test evaluates
3. The physiological function and implications of abnormal results
4. Key factors that cause abnormal or critical results
5. Personalized health improvement strategies

# HEMATOLOGY SYSTEM TESTS

## Complete Blood Count (CBC)

### White Blood Cell (WBC) Count

 **Normal Range:** 4,500-11,000/μL

 **Abnormal Range:** 1,000-4,499/μL or 11,001-20,000/μL

 **Critical Range:** <1,000/μL or >20,000/μL

 **Body System:** Immune

 **Function:** Critical component of immune defense against infections; first responders to pathogens and tissue damage

#### Implications of Abnormal Results:

 **Elevated (Leukocytosis):** Bacterial infections, inflammation, tissue damage/trauma, leukemia, stress response, corticosteroid use

 **Decreased (Leukopenia):** Viral infections, bone marrow disorders, autoimmune disorders, certain medications (chemotherapy), severe infections, radiation exposure

#### Health Improvement Strategies:

 Regular hand washing and good hygiene practices

 Adequate nutrient intake (protein, zinc, vitamin C, vitamin D)  Regular moderate exercise (improves immune function)

 Adequate sleep (7-9 hours)

 Stress management techniques  Limiting alcohol consumption

 Smoking cessation

 Avoiding unnecessary antibiotic use  Regular health screenings

### Red Blood Cell (RBC) Count

 **Normal Range:** Males: 4.5-5.9 million/μL, Females: 4.0-5.2 million/μL

 **Abnormal Range:** Males: 3.5-4.4 or 6.0-6.5 million/μL, Females: 3.0-3.9 or 5.3-5.9 million/μL

 **Critical Range:** Males: <3.5 or >6.5 million/μL, Females: <3.0 or >5.9 million/μL

 **Body System:** Cardiovascular

 **Function:** Transport oxygen from lungs to tissues and carbon dioxide from tissues to lungs

#### Implications of Abnormal Results:

 **Elevated (Polycythemia):** Dehydration, living at high altitude, lung disease, certain kidney diseases, polycythemia vera, smoking

 **Decreased (Anemia):** Iron deficiency, vitamin B12/folate deficiency, blood loss, hemolysis, chronic disease, bone marrow disorders, kidney disease

#### Health Improvement Strategies:

 Iron-rich diet (lean red meat, beans, fortified cereals, dark leafy greens)  Vitamin C consumption with iron for better absorption

 B12 and folate from diet or supplements  Adequate hydration

 Regular screening for anemia in high-risk individuals  Treatment of underlying conditions causing anemia

 Oxygen supplementation for hypoxic conditions when medically indicated

### Hemoglobin (Hgb)

 **Normal Range:** Males: 13.5-17.5 g/dL, Females: 12.0-15.5 g/dL

 **Abnormal Range:** Males: 10.0-13.4 or 17.6-18.5 g/dL, Females: 9.0-11.9 or 15.6-16.5 g/dL

 **Critical Range:** Males: <10.0 or >18.5 g/dL, Females: <9.0 or >16.5 g/dL

 **Body System:** Cardiovascular

 **Function:** Protein in red blood cells that binds oxygen for transport throughout the body

#### Implications of Abnormal Results:

 **Elevated:** Dehydration, polycythemia, COPD, heart failure, living at high altitude

 **Decreased:** Anemia (various types), blood loss, hemolysis, bone marrow failure, chronic disease, nutritional deficiencies, kidney disease

#### Health Improvement Strategies:

 Similar to RBC strategies

 Addressing specific causes of anemia

 Iron supplementation when appropriate

 Erythropoietin treatment for certain conditions (under medical supervision)  Blood transfusions for severe anemia when medically indicated

### Hematocrit (Hct)

 **Normal Range:** Males: 41-53%, Females: 36-46%

 **Abnormal Range:** Males: 30-40% or 54-60%, Females: 28-35% or 47-52%

 **Critical Range:** Males: <30% or >60%, Females: <28% or >52%

 **Body System:** Cardiovascular

 **Function:** Percentage of blood volume occupied by red blood cells; reflects RBC mass and fluid status

#### Implications of Abnormal Results:

 Similar to hemoglobin, plus specific indications of hydration status

#### Health Improvement Strategies:

 Maintaining proper hydration

 Same strategies as for hemoglobin and RBCs

### Platelets

 **Normal Range:** 150,000-450,000/μL

 **Abnormal Range:** 50,000-149,999/μL or 451,000-1,000,000/μL

 **Critical Range:** <50,000/μL or >1,000,000/μL

 **Body System:** Cardiovascular/Hematologic

 **Function:** Essential for blood clotting; form platelet plug in initial hemostasis

#### Implications of Abnormal Results:

 **Elevated (Thrombocytosis):** Inflammatory conditions, infections, iron deficiency, post- splenectomy, certain cancers, myeloproliferative disorders

 **Decreased (Thrombocytopenia):** Immune thrombocytopenia, medications, leukemia, viral infections, DIC, TTP/HUS, bone marrow failure, hypersplenism

#### Health Improvement Strategies:

 Avoiding medications known to affect platelets unless necessary  Limiting alcohol consumption

 Proper management of autoimmune conditions  Diet rich in folate, vitamin B12, and iron

 Regular monitoring for those with chronic conditions affecting platelets

### Coagulation Profile

 **Prothrombin Time (PT):** 11-13.5 seconds (normal), 13.6-17 seconds (abnormal), >17 seconds (critical)

 **INR:** 0.8-1.2 (normal), 1.3-3.0 (therapeutic for anticoagulation), >3.0 (critical)

 **aPTT:** 25-35 seconds (normal), 36-50 seconds (abnormal), >50 seconds (critical)

 **Body System:** Cardiovascular/Hematologic

 **Function:** Evaluates blood clotting function; PT assesses extrinsic pathway, aPTT assesses intrinsic pathway

#### Implications of Abnormal Results:

 **Prolonged PT/INR:** Warfarin therapy, vitamin K deficiency, liver disease, DIC, factor VII deficiency

 **Prolonged aPTT:** Heparin therapy, hemophilia, von Willebrand disease, lupus anticoagulant, factor deficiencies

#### Health Improvement Strategies:

 Vitamin K-rich foods (for non-anticoagulated patients)  Careful monitoring of anticoagulant therapy

 Management of underlying liver disease

 Medication adjustment based on test results

 Genetic counseling for hereditary coagulation disorders

# CARDIOVASCULAR SYSTEM TESTS

## Lipid Profile

### Total Cholesterol

 **Normal Range:** <200 mg/dL

 **Abnormal Range:** 200-239 mg/dL

 **Critical Range:** ≥240 mg/dL

 **Body System:** Cardiovascular

 **Function:** Component of cell membranes, precursor for hormones and vitamin D; excessive levels contribute to atherosclerosis

#### Implications of Abnormal Results:

 **Elevated:** Increased risk of atherosclerosis, coronary artery disease, stroke

 **Factors causing elevation:** Genetic predisposition, high saturated fat diet, obesity, hypothyroidism, liver disease, kidney disease

#### Health Improvement Strategies:

 Mediterranean or DASH diet pattern  Limiting saturated and trans fats

 Increasing soluble fiber (oats, beans, fruits)

 Regular physical activity (150+ minutes/week moderate intensity)  Weight management to healthy BMI

 Plant sterols/stanols supplementation

 Medication (statins, etc.) when lifestyle changes are insufficient

### LDL Cholesterol (Low-Density Lipoprotein)

 **Normal Range:** <100 mg/dL

 **Abnormal Range:** 100-159 mg/dL

 **Critical Range:** ≥160 mg/dL

 **Body System:** Cardiovascular

 **Function:** Transports cholesterol from liver to tissues; contributes to plaque formation in arteries

#### Implications of Abnormal Results:

 **Elevated:** Primary risk factor for coronary artery disease and atherosclerosis

 **Factors causing elevation:** Genetic factors (familial hypercholesterolemia), diet high in saturated/trans fats, obesity, sedentary lifestyle, metabolic syndrome

#### Health Improvement Strategies:

 Plant-based or Mediterranean diet  Soluble fiber (10-25g daily)

 Plant sterols/stanols (2g daily)  Regular aerobic exercise

 Weight management  Omega-3 fatty acids

 Limiting saturated fat (<7% of calories) and eliminating trans fats  Medication therapy when indicated

### HDL Cholesterol (High-Density Lipoprotein)

 **Normal Range:** >40 mg/dL (men), >50 mg/dL (women)

 **Abnormal Range:** 30-40 mg/dL (men), 30-50 mg/dL (women)

 **Critical Range:** <30 mg/dL

 **Body System:** Cardiovascular

 **Function:** Removes excess cholesterol from tissues and transports to liver for excretion; protective against atherosclerosis

#### Implications of Abnormal Results:

 **Decreased:** Increased cardiovascular risk; seen in metabolic syndrome, insulin resistance, physical inactivity, smoking, genetic factors

#### Health Improvement Strategies:

 Regular aerobic exercise (most effective intervention)  Weight management

 Consuming monounsaturated fats (olive oil, avocados, nuts)  Moderate alcohol consumption (if already drinking)

 Smoking cessation

 Omega-3 fatty acids from fatty fish  Limiting refined carbohydrates

### Triglycerides

 **Normal Range:** <150 mg/dL

 **Abnormal Range:** 150-499 mg/dL

 **Critical Range:** ≥500 mg/dL

 **Body System:** Cardiovascular/Metabolic

 **Function:** Main form of fat storage in the body; energy source

#### Implications of Abnormal Results:

 **Elevated:** Increased cardiovascular risk; associated with metabolic syndrome, diabetes, fatty liver; very high levels increase pancreatitis risk

 **Factors causing elevation:** Excessive carbohydrate intake (especially refined), alcohol consumption, obesity, diabetes, hypothyroidism, kidney disease, genetic disorders

#### Health Improvement Strategies:

 Limiting refined carbohydrates and sugars  Weight management

 Regular physical activity

 Limiting alcohol consumption

 Omega-3 fatty acids (2-4g daily)

 Managing diabetes and insulin resistance

 Medication when lifestyle changes insufficient

## Cardiac Markers

### Troponin I/T

 **Troponin I Normal Range:** <0.04 ng/mL

 **Troponin I Abnormal Range:** 0.04-0.5 ng/mL

 **Troponin I Critical Range:** >0.5 ng/mL

 **Troponin T Normal Range:** <0.01 ng/mL

 **Troponin T Abnormal Range:** 0.01-0.1 ng/mL

 **Troponin T Critical Range:** >0.1 ng/mL

 **Body System:** Cardiovascular

 **Function:** Proteins specific to cardiac muscle; released when heart muscle is damaged

#### Implications of Abnormal Results:

 **Elevated:** Myocardial infarction (heart attack), myocarditis, cardiac contusion, cardiac procedures, severe heart failure, sepsis with cardiac involvement

#### Health Improvement Strategies:

 Heart-healthy lifestyle for prevention

 Prompt medical attention for chest pain  Cardiac rehabilitation after cardiac events  Managing cardiovascular risk factors

 Following treatment plan after cardiac events

### B-type Natriuretic Peptide (BNP)

 **Normal Range:** <100 pg/mL

 **Abnormal Range:** 100-400 pg/mL

 **Critical Range:** >400 pg/mL

 **Body System:** Cardiovascular

 **Function:** Hormone released from cardiac ventricles in response to stretching; helps regulate blood pressure and fluid balance

#### Implications of Abnormal Results:

 **Elevated:** Heart failure, volume overload, pulmonary hypertension, left ventricular hypertrophy, valvular heart disease

#### Health Improvement Strategies:

 Sodium restriction (<2,000 mg/day)  Fluid management as recommended  Regular physical activity as tolerated  Medication adherence

 Regular monitoring for heart failure patients

 Weight monitoring (sudden increases suggest fluid retention)

### High-sensitivity C-Reactive Protein (hs-CRP)

 **Normal Range:** <1 mg/L (low risk), 1-3 mg/L (moderate risk)

 **Abnormal Range:** 3-10 mg/L (high risk)

 **Critical Range:** >10 mg/L

 **Body System:** Cardiovascular/Immune

 **Function:** Inflammatory marker associated with atherosclerosis and cardiovascular risk

#### Implications of Abnormal Results:

 **Elevated:** Increased cardiovascular risk, systemic inflammation, infection, trauma, autoimmune conditions

#### Health Improvement Strategies:

 Mediterranean anti-inflammatory diet  Regular physical activity

 Weight management  Smoking cessation

 Omega-3 fatty acids

 Statins (have anti-inflammatory effects)  Addressing sleep apnea if present

 Stress management techniques

# RESPIRATORY SYSTEM TESTS

## Pulmonary Function Tests

### Forced Vital Capacity (FVC)

 **Normal Range:** 80-120% predicted  **Abnormal Range:** 60-79% predicted  **Critical Range:** <60% predicted

 **Body System:** Respiratory

 **Function:** Maximum volume of air that can be forcibly exhaled after deep inhalation

#### Implications of Abnormal Results:

 **Decreased:** Restrictive lung diseases (pulmonary fibrosis, sarcoidosis), chest wall disorders, neuromuscular diseases, lung resection

#### Health Improvement Strategies:

 Regular aerobic exercise

 Pulmonary rehabilitation programs  Breathing exercises

 Avoiding smoking and environmental irritants

 Weight management for those with obesity affecting lung capacity  Disease-specific management strategies

### Forced Expiratory Volume in 1 second (FEV1)

 **Normal Range:** 80-120% predicted  **Abnormal Range:** 60-79% predicted  **Critical Range:** <60% predicted

 **Body System:** Respiratory

 **Function:** Volume of air that can be forcibly exhaled in the first second

#### Implications of Abnormal Results:

 **Decreased:** Obstructive lung diseases (asthma, COPD, bronchiectasis), airway obstruction

#### Health Improvement Strategies:

 Bronchodilators and other medications as prescribed  Smoking cessation

 Avoiding allergens and triggers  Pulmonary rehabilitation

 Airway clearance techniques  Proper inhaler technique

 Annual influenza vaccination

### FEV1/FVC Ratio

 **Normal Range:** >70%

 **Abnormal Range:** 60-69%

 **Critical Range:** <60%

 **Body System:** Respiratory

 **Function:** Proportion of vital capacity exhaled in first second; differentiates obstructive from restrictive disorders

#### Implications of Abnormal Results:

 **Decreased:** Obstructive lung diseases (COPD, asthma, bronchiectasis)

#### Health Improvement Strategies:

 Disease-specific management

 Bronchodilators when indicated

 Inhaled corticosteroids when indicated  Pulmonary rehabilitation

 Breathing techniques

## Arterial Blood Gas Analysis

### pH

 **Normal Range:** 7.35-7.45

 **Abnormal Range:** 7.20-7.34 or 7.46-7.55

 **Critical Range:** <7.20 or >7.55

 **Body System:** Respiratory/Metabolic

 **Function:** Measure of blood acidity/alkalinity; regulated by respiratory and renal systems

#### Implications of Abnormal Results:

 **Decreased (Acidemia):** Respiratory acidosis (hypoventilation), metabolic acidosis (lactic acidosis, ketoacidosis, renal failure)

 **Increased (Alkalemia):** Respiratory alkalosis (hyperventilation), metabolic alkalosis (vomiting, diuretic use)

#### Health Improvement Strategies:

 Treating underlying causes

 Appropriate ventilation support  Medication adjustment

 Fluid and electrolyte management

 Addressing anxiety causing hyperventilation  Diabetic control for ketoacidosis

### PaO2 (Partial Pressure of Oxygen)

 **Normal Range:** 80-100 mmHg  **Abnormal Range:** 60-79 mmHg  **Critical Range:** <60 mmHg

 **Body System:** Respiratory

 **Function:** Measures oxygen dissolved in arterial blood; reflects lung's ability to oxygenate blood

#### Implications of Abnormal Results:

 **Decreased (Hypoxemia):** Lung diseases, ventilation-perfusion mismatch, right-to-left shunts, hypoventilation, high altitude

#### Health Improvement Strategies:

 Oxygen therapy when indicated  Treating underlying lung disease

 Proper positioning to optimize ventilation  Breathing exercises

 Addressing sleep apnea if present  Pulmonary rehabilitation

### PaCO2 (Partial Pressure of Carbon Dioxide)

 **Normal Range:** 35-45 mmHg

 **Abnormal Range:** 25-34 or 46-60 mmHg

 **Critical Range:** <25 or >60 mmHg

 **Body System:** Respiratory

 **Function:** Measures carbon dioxide dissolved in arterial blood; reflects adequacy of ventilation

#### Implications of Abnormal Results:

 **Decreased:** Hyperventilation (anxiety, pain, early sepsis), compensation for metabolic acidosis

 **Increased:** Hypoventilation (sedation, neuromuscular disorders), COPD, severe asthma, respiratory fatigue/failure

#### Health Improvement Strategies:

 Ventilatory support when needed  Treating underlying causes

 Bronchodilators for obstructive diseases

 Breathing techniques for anxiety-induced hyperventilation  Avoiding respiratory depressants

# METABOLIC & ENDOCRINE SYSTEM TESTS

## Glucose Metabolism

### Fasting Blood Glucose

 **Normal Range:** 70-99 mg/dL

 **Abnormal Range:** 100-125 mg/dL (prediabetes)

 **Critical Range:** ≥126 mg/dL (diabetes) or <50 mg/dL

 **Body System:** Endocrine/Metabolic

 **Function:** Primary energy source for cells; tightly regulated by insulin and other hormones

#### Implications of Abnormal Results:

 **Elevated (Hyperglycemia):** Diabetes mellitus, prediabetes, stress, medications, pancreatitis, Cushing's syndrome

 **Decreased (Hypoglycemia):** Insulin excess, medications, insulinoma, alcohol, liver disease, hormone deficiencies

#### Health Improvement Strategies:

 Low-glycemic diet emphasizing whole foods  Regular physical activity (150+ minutes/week)  Weight management to healthy BMI

 Stress reduction techniques

 Adequate sleep (7-9 hours nightly)  Regular meal timing

 Limiting refined carbohydrates and added sugars  Medication adherence for diabetics

 Regular monitoring for those at risk or diagnosed

### Hemoglobin A1c (HbA1c)

 **Normal Range:** <5.7%

 **Abnormal Range:** 5.7-6.4% (prediabetes)

 **Critical Range:** ≥6.5% (diabetes)

 **Body System:** Endocrine/Metabolic

 **Function:** Reflects average blood glucose over approximately 3 months

#### Implications of Abnormal Results:

 **Elevated:** Chronic hyperglycemia, diabetes, prediabetes, increased risk of complications

 **Falsely elevated:** Anemia, kidney failure, liver disease, certain hemoglobinopathies

 **Falsely decreased:** Hemolytic anemia, blood loss, certain hemoglobinopathies

#### Health Improvement Strategies:

 Same as fasting glucose strategies

 Regular monitoring every 3-6 months for diabetics  Comprehensive diabetes management

 Regular screening for diabetes complications

 Setting personalized A1c targets with healthcare provider

## Thyroid Function

### Thyroid Stimulating Hormone (TSH)

 **Normal Range:** 0.4-4.0 mIU/L

 **Abnormal Range:** 0.1-0.3 mIU/L or 4.1-10.0 mIU/L

 **Critical Range:** <0.1 mIU/L or >10.0 mIU/L

 **Body System:** Endocrine

 **Function:** Pituitary hormone that stimulates thyroid gland to produce thyroid hormones

#### Implications of Abnormal Results:

 **Elevated:** Primary hypothyroidism, subclinical hypothyroidism

 **Decreased:** Hyperthyroidism, excessive thyroid hormone replacement, pituitary dysfunction

#### Health Improvement Strategies:

 Thyroid medication as prescribed  Regular medication monitoring

 Selenium-rich foods (Brazil nuts, seafood)  Iodine adequacy through iodized salt

 Limiting goitrogenic foods when indicated  Addressing autoimmune factors

 Regular follow-up for dose adjustments

### Free T4 & Free T3

 **Free T4 Normal Range:** 0.8-1.8 ng/dL

 **Free T4 Abnormal Range:** 0.4-0.7 ng/dL or 1.9-3.0 ng/dL

 **Free T4 Critical Range:** <0.4 ng/dL or >3.0 ng/dL

 **Free T3 Normal Range:** 2.3-4.2 pg/mL

 **Free T3 Abnormal Range:** 1.5-2.2 pg/mL or 4.3-6.0 pg/mL

 **Free T3 Critical Range:** <1.5 pg/mL or >6.0 pg/mL

 **Body System:** Endocrine

 **Function:** Thyroid hormones that regulate metabolism, growth, development, and body temperature

#### Implications of Abnormal Results:

 **Elevated:** Hyperthyroidism, thyroiditis, excessive thyroid hormone replacement

 **Decreased:** Hypothyroidism, pituitary dysfunction, severe illness

#### Health Improvement Strategies:

 Appropriate medication management  Regular monitoring

 Addressing underlying autoimmune conditions  Supporting overall thyroid health

 Avoiding interfering supplements and medications

## Adrenal Function

### Cortisol

 **Morning Cortisol Normal Range:** 5-25 μg/dL

 **Morning Cortisol Abnormal Range:** 2-4 μg/dL or 26-35 μg/dL

 **Morning Cortisol Critical Range:** <2 μg/dL or >35 μg/dL

 **Body System:** Endocrine

 **Function:** Stress hormone that regulates metabolism, immune response, and blood pressure

#### Implications of Abnormal Results:

 **Elevated:** Cushing's syndrome, stress, exogenous steroid use, depression, alcoholism

 **Decreased:** Addison's disease, pituitary dysfunction, adrenal suppression from exogenous steroids

#### Health Improvement Strategies:

 Stress management techniques (meditation, yoga, deep breathing)  Regular exercise (appropriate intensity)

 Adequate sleep (7-9 hours nightly)  Regular sleep-wake schedule

 Balanced nutrition

 Limiting caffeine and alcohol

 Adaptogenic herbs when appropriate

 Proper medication management if on corticosteroids

# RENAL SYSTEM TESTS

## Kidney Function

### Blood Urea Nitrogen (BUN)

 **Normal Range:** 7-20 mg/dL

 **Abnormal Range:** 21-50 mg/dL

 **Critical Range:** >50 mg/dL

 **Body System:** Renal

 **Function:** Nitrogen waste product from protein metabolism; eliminated by kidneys

#### Implications of Abnormal Results:

 **Elevated:** Kidney disease, dehydration, high protein diet, gastrointestinal bleeding, heart failure, urinary tract obstruction

 **Decreased:** Liver failure, low protein diet, malnutrition, overhydration, pregnancy

#### Health Improvement Strategies:

 Adequate hydration

 Appropriate protein intake based on kidney function  Blood pressure control

 Managing diabetes effectively

 Avoiding nephrotoxic medications

 Regular kidney function monitoring in at-risk individuals

### Creatinine

 **Normal Range:** Males: 0.7-1.3 mg/dL, Females: 0.6-1.1 mg/dL

 **Abnormal Range:** Males: 1.4-2.0 mg/dL, Females: 1.2-2.0 mg/dL

 **Critical Range:** >2.0 mg/dL

 **Body System:** Renal

 **Function:** Muscle breakdown product eliminated by kidneys; best endogenous marker of kidney function

#### Implications of Abnormal Results:

 **Elevated:** Kidney disease/injury, muscle injury, certain medications, urinary tract obstruction

 **Decreased:** Decreased muscle mass, malnutrition, advanced age

#### Health Improvement Strategies:

 Blood pressure control (<130/80 mmHg)  Diabetes management

 Adequate hydration

 Avoiding nephrotoxic medications

 Appropriate protein intake based on kidney function  Regular monitoring in at-risk individuals

### Estimated Glomerular Filtration Rate (eGFR)

 **Normal Range:** >90 mL/min/1.73m²

 **Abnormal Range:** 60-89 mL/min/1.73m² (Stage 2), 30-59 mL/min/1.73m² (Stage 3)

 **Critical Range:** <30 mL/min/1.73m² (Stage 4-5)

 **Body System:** Renal

 **Function:** Calculated measure of kidney filtration function; best estimate of overall kidney function

#### Implications of Abnormal Results:

 **Decreased:** Chronic kidney disease, acute kidney injury, aging

#### Health Improvement Strategies:

 Blood pressure control  Diabetes management

 Medication review and adjustment

 Limiting dietary protein when GFR <60  Sodium restriction (<2,300 mg/day)

 Monitoring and managing metabolic acidosis  Regular nephrology care for advanced CKD

## Electrolytes

### Sodium

 **Normal Range:** 135-145 mEq/L

 **Abnormal Range:** 125-134 mEq/L or 146-155 mEq/L

 **Critical Range:** <125 mEq/L or >155 mEq/L

 **Body System:** Renal/Endocrine

 **Function:** Principal extracellular electrolyte; regulates fluid balance, nerve impulse transmission, and muscle function

#### Implications of Abnormal Results:

 **Elevated (Hypernatremia):** Dehydration, excessive sodium intake, diabetes insipidus, Cushing's syndrome

 **Decreased (Hyponatremia):** SIADH, heart failure, liver cirrhosis, kidney disease, diuretics, excessive water intake

#### Health Improvement Strategies:

 Appropriate water intake based on conditions

 Balanced sodium intake (typically 2,000-2,300 mg/day)  Medication adjustment when needed

 Treating underlying conditions

 Regular monitoring in at-risk individuals

### Potassium

 **Normal Range:** 3.5-5.0 mEq/L

 **Abnormal Range:** 3.0-3.4 mEq/L or 5.1-6.0 mEq/L

 **Critical Range:** <3.0 mEq/L or >6.0 mEq/L

 **Body System:** Renal/Cardiovascular

 **Function:** Principal intracellular electrolyte; critical for heart, nerve, and muscle function

#### Implications of Abnormal Results:

 **Elevated (Hyperkalemia):** Kidney failure, adrenal insufficiency, ACE inhibitors, potassium-sparing diuretics, massive cell destruction

 **Decreased (Hypokalemia):** Diuretics, vomiting, diarrhea, Cushing's syndrome, hyperaldosteronism

#### Health Improvement Strategies:

 Potassium-rich foods for hypokalemia (bananas, potatoes, avocados)  Limiting potassium intake for hyperkalemia

 Medication review and adjustment

 Regular monitoring while on diuretics

 Addressing underlying causes of imbalance

# HEPATIC SYSTEM TESTS

## Liver Function Tests

### Alanine Aminotransferase (ALT)

 **Normal Range:** Males: 7-56 U/L, Females: 7-45 U/L

 **Abnormal Range:** Males: 57-200 U/L, Females: 46-200 U/L

 **Critical Range:** >200 U/L

 **Body System:** Hepatic

 **Function:** Enzyme primarily found in liver cells; released when liver cells are damaged

#### Implications of Abnormal Results:

 **Elevated:** Viral hepatitis, alcoholic liver disease, nonalcoholic fatty liver disease, medications, autoimmune hepatitis, ischemic liver injury

#### Health Improvement Strategies:

 Limiting or avoiding alcohol

 Weight management for fatty liver  Hepatitis vaccination

 Avoiding hepatotoxic medications  Mediterranean diet pattern

 Regular exercise

 Coffee consumption (may be protective)  Antioxidant-rich foods

 Milk thistle supplements (when recommended)

### Aspartate Aminotransferase (AST)

 **Normal Range:** Males: 8-48 U/L, Females: 8-43 U/L

 **Abnormal Range:** Males: 49-200 U/L, Females: 44-200 U/L

 **Critical Range:** >200 U/L

 **Body System:** Hepatic (also found in heart, muscle, kidney, brain)

 **Function:** Enzyme found in various tissues; less specific for liver than ALT

#### Implications of Abnormal Results:

 **Elevated:** Similar to ALT plus muscle damage, myocardial infarction, hemolysis

 **AST/ALT ratio >2:** Suggests alcoholic liver disease or cirrhosis

#### Health Improvement Strategies:

 Similar to ALT strategies

 Additional focus on muscle health if muscle damage is the cause

### Alkaline Phosphatase (ALP)

 **Normal Range:** 40-120 U/L

 **Abnormal Range:** 121-300 U/L

 **Critical Range:** >300 U/L

 **Body System:** Hepatic/Biliary/Bone

 **Function:** Enzyme found in liver, bone, placenta, and intestines; helps in diagnosing source of liver problems

#### Implications of Abnormal Results:

 **Elevated:** Bile duct obstruction, primary biliary cholangitis, primary sclerosing cholangitis, bone growth/disease, pregnancy

#### Health Improvement Strategies:

 Treating underlying biliary conditions

 Addressing bone disorders if bone-derived

 Vitamin D and calcium adequacy for bone health

 Ursodeoxycholic acid for certain cholestatic conditions (when prescribed)

### Gamma-Glutamyl Transferase (GGT)

 **Normal Range:** Males: 8-61 U/L, Females: 5-36 U/L

 **Abnormal Range:** Males: 62-200 U/L, Females: 37-150 U/L

 **Critical Range:** Males: >200 U/L, Females: >150 U/L

 **Body System:** Hepatic

 **Function:** Enzyme sensitive to alcohol consumption and medications; helps differentiate source of ALP elevation

#### Implications of Abnormal Results:

 **Elevated:** Alcohol consumption, medications, biliary disease, fatty liver, hepatitis

#### Health Improvement Strategies:

 Alcohol reduction or abstinence  Medication review

 Weight management

 Liver-protective diet (Mediterranean pattern)  Regular exercise

### Bilirubin (Total, Direct, Indirect)

 **Total Bilirubin Normal Range:** 0.1-1.2 mg/dL

 **Total Bilirubin Abnormal Range:** 1.3-3.0 mg/dL

 **Total Bilirubin Critical Range:** >3.0 mg/dL

 **Direct Bilirubin Normal Range:** 0.0-0.3 mg/dL

 **Indirect Bilirubin Normal Range:** 0.1-0.9 mg/dL

 **Body System:** Hepatic/Hematologic

 **Function:** Breakdown product of hemoglobin; direct (conjugated) bilirubin processed by liver, indirect (unconjugated) not yet processed

#### Implications of Abnormal Results:

 **Elevated Total and Direct:** Bile duct obstruction, hepatocellular damage, medications

 **Elevated Total and Indirect:** Hemolysis, Gilbert's syndrome, neonatal jaundice

#### Health Improvement Strategies:

 Treating underlying liver or biliary condition  Addressing hemolytic disorders

 No treatment needed for Gilbert's syndrome  Adequate hydration

 Avoiding hepatotoxic medications

### Albumin

 **Normal Range:** 3.5-5.0 g/dL

 **Abnormal Range:** 2.8-3.4 g/dL

 **Critical Range:** <2.8 g/dL

 **Body System:** Hepatic

 **Function:** Major protein produced by liver; maintains oncotic pressure and transports hormones, drugs, and other substances

#### Implications of Abnormal Results:

 **Decreased:** Chronic liver disease, malnutrition, protein-losing enteropathy, nephrotic syndrome, burns, inflammation

#### Health Improvement Strategies:

 Adequate protein intake (1-1.5 g/kg/day)  Treating underlying liver disease

 Nutritional support in malnutrition

 Anti-inflammatory diet for chronic inflammation

 Regular monitoring in chronic liver disease

### Prothrombin Time (PT)/INR

 **PT Normal Range:** 11-13.5 seconds

 **PT Abnormal Range:** 13.6-17 seconds

 **PT Critical Range:** >17 seconds

 **INR Normal Range:** 0.8-1.2

 **Body System:** Hepatic/Hematologic

 **Function:** Measures liver's ability to produce clotting factors; important for assessing synthetic function

#### Implications of Abnormal Results:

 **Prolonged:** Liver failure, vitamin K deficiency, anticoagulant therapy, DIC

#### Health Improvement Strategies:

 Vitamin K-rich foods (unless on warfarin)  Treating underlying liver disease

 Monitoring for bleeding risk

 Medication adjustment when appropriate

# DIGESTIVE SYSTEM TESTS

## Pancreatic Function

### Amylase

 **Normal Range:** 30-110 U/L

 **Abnormal Range:** 111-300 U/L

 **Critical Range:** >300 U/L

 **Body System:** Digestive

 **Function:** Enzyme that digests carbohydrates; produced primarily by pancreas and salivary glands

#### Implications of Abnormal Results:

 **Elevated:** Acute pancreatitis, pancreatic cancer, perforated ulcer, gallstones, kidney failure (decreased clearance)

#### Health Improvement Strategies:

 Limited alcohol consumption

 Low-fat diet if pancreatitis history

 Gallstone prevention (maintain healthy weight, moderate fat intake)  Adequate hydration

 Smoking cessation

### Lipase

 **Normal Range:** 10-60 U/L

 **Abnormal Range:** 61-180 U/L

 **Critical Range:** >180 U/L

 **Body System:** Digestive

 **Function:** Enzyme that digests fats; more specific to pancreas than amylase

#### Implications of Abnormal Results:

 **Elevated:** Acute pancreatitis, pancreatic cancer/tumors, pancreatic duct obstruction, kidney failure

#### Health Improvement Strategies:

 Similar to amylase strategies

 Dietary modification during acute pancreatitis (clear liquids, low fat)  Gradual return to normal diet as tolerated

### Fecal Elastase-1

 **Normal Range:** >200 μg/g stool

 **Abnormal Range:** 100-200 μg/g stool

 **Critical Range:** <100 μg/g stool

 **Body System:** Digestive

 **Function:** Pancreatic enzyme; low levels indicate pancreatic exocrine insufficiency

#### Implications of Abnormal Results:

 **Decreased:** Chronic pancreatitis, cystic fibrosis, pancreatic cancer, pancreatic resection

#### Health Improvement Strategies:

 Pancreatic enzyme replacement therapy  Small, frequent meals

 Medium-chain triglyceride (MCT) oil supplementation  Fat-soluble vitamin supplementation (A, D, E, K)

 Low-fat diet or fat timing with enzyme intake

## Intestinal Absorption and Inflammation

### Fecal Calprotectin

 **Normal Range:** <50 μg/g

 **Abnormal Range:** 50-200 μg/g

 **Critical Range:** >200 μg/g

 **Body System:** Digestive

 **Function:** Protein released from neutrophils; marker of intestinal inflammation

#### Implications of Abnormal Results:

 **Elevated:** Inflammatory bowel disease, infections, colorectal cancer, NSAID enteropathy

#### Health Improvement Strategies:

 Anti-inflammatory diet

 Identifying and removing food triggers

 Probiotics (specific strains for specific conditions)  Omega-3 fatty acids

 Medication adherence for IBD patients  Regular monitoring for disease activity

### Celiac Disease Antibodies

 **Anti-Tissue Transglutaminase IgA Normal Range:** <20 U

 **Anti-Tissue Transglutaminase IgA Abnormal Range:** 20-30 U

 **Anti-Tissue Transglutaminase IgA Critical Range:** >30 U

 **Body System:** Digestive/Immune

 **Function:** Antibodies produced in celiac disease in response to gluten exposure

#### Implications of Abnormal Results:

 **Elevated:** Celiac disease, sometimes other autoimmune conditions

#### Health Improvement Strategies:

 Strict gluten-free diet for confirmed celiac disease  Nutritional supplementation to correct deficiencies

 Regular follow-up to ensure antibody normalization  Screening first-degree relatives

 Education on hidden sources of gluten

### Gut Microbiome Analysis

 **Bacterial Diversity Normal Range:** High diversity

 **Bacterial Diversity Abnormal Range:** Moderate diversity

 **Bacterial Diversity Critical Range:** Low diversity

 **Body System:** Digestive

 **Function:** Assesses the variety and balance of bacterial species in gut; affects many aspects of health

#### Implications of Abnormal Results:

 **Decreased Diversity:** Associated with various conditions including IBD, IBS, obesity, diabetes

 **Pathogen Overgrowth:** Can indicate dysbiosis, infection, or imbalance

#### Health Improvement Strategies:

 Diverse plant foods (aim for 30+ different plant foods weekly)  Fermented foods (yogurt, kefir, sauerkraut, kimchi)

 Prebiotic fiber (onions, garlic, leeks, asparagus, bananas)  Limiting antibiotics when possible

 Regular physical activity  Stress management

 Adequate sleep

 Specific probiotics based on testing results

## Gastrointestinal Infection and Parasites

### Stool Culture

 **Normal Range:** No pathogenic bacteria

 **Abnormal Range:** Presence of pathogenic bacteria

 **Critical Range:** High concentration of pathogens or particularly virulent strains

 **Body System:** Digestive

 **Function:** Identifies bacterial pathogens causing gastrointestinal infection

#### Implications of Abnormal Results:

 **Positive:** Bacterial gastroenteritis from various pathogens (Salmonella, Shigella, Campylobacter, pathogenic E. coli)

#### Health Improvement Strategies:

 Appropriate antibiotic therapy when indicated  Proper food handling and preparation

 Hand hygiene

 Safe water consumption

 Proper cooking temperatures for meats

 Probiotics during/after antibiotic treatment

### Ova and Parasite Examination

 **Normal Range:** No parasites or ova detected

 **Abnormal Range:** Presence of parasites or ova

 **Critical Range:** Heavy parasite burden

 **Body System:** Digestive

 **Function:** Identifies parasitic infections of gastrointestinal tract

#### Implications of Abnormal Results:

 **Positive:** Intestinal parasites (Giardia, Entamoeba, Cryptosporidium, helminths)

#### Health Improvement Strategies:

 Appropriate antiparasitic medication  Improved sanitation

 Safe water consumption

 Proper food washing and preparation  Regular deworming in endemic areas  Hand hygiene

# IMMUNE SYSTEM TESTS

## Inflammatory Markers

### Erythrocyte Sedimentation Rate (ESR)

 **Normal Range:** Males: 0-15 mm/hr, Females: 0-20 mm/hr

 **Abnormal Range:** Males: 16-50 mm/hr, Females: 21-60 mm/hr

 **Critical Range:** Males: >50 mm/hr, Females: >60 mm/hr

 **Body System:** Immune

 **Function:** Non-specific marker of inflammation; measures how quickly red blood cells settle in a tube

#### Implications of Abnormal Results:

 **Elevated:** Infections, inflammation, autoimmune diseases, cancer, pregnancy, anemia

#### Health Improvement Strategies:

 Anti-inflammatory diet  Regular physical activity

 Treating underlying conditions  Weight management

 Adequate sleep  Stress reduction

### C-Reactive Protein (CRP)

 **Normal Range:** <3 mg/L

 **Abnormal Range:** 3-10 mg/L

 **Critical Range:** >10 mg/L

 **Body System:** Immune

 **Function:** Acute phase protein produced by liver in response to inflammation; rises rapidly and falls quickly

#### Implications of Abnormal Results:

 **Elevated:** Infections, inflammation, tissue injury, autoimmune diseases, malignancy

#### Health Improvement Strategies:

 Anti-inflammatory diet (Mediterranean pattern)  Omega-3 fatty acids

 Regular exercise

 Weight management  Adequate sleep

 Treating underlying infections/conditions  Smoking cessation

## Immunoglobulins

### Immunoglobulin G (IgG)

 **Normal Range:** 700-1,600 mg/dL

 **Abnormal Range:** 400-699 mg/dL or 1,601-2,000 mg/dL

 **Critical Range:** <400 mg/dL or >2,000 mg/dL

 **Body System:** Immune

 **Function:** Most abundant antibody class; provides long-term immunity against infections

#### Implications of Abnormal Results:

 **Elevated:** Chronic infections, autoimmune diseases, liver disease, multiple myeloma

 **Decreased:** Primary immunodeficiency, protein-losing conditions, medications, malignancies

#### Health Improvement Strategies:

 Adequate nutrition with complete protein

 Immunoglobulin replacement therapy if indicated  Treating underlying conditions

 Infection prevention strategies  Vaccinations when appropriate

### Immunoglobulin A (IgA)

 **Normal Range:** 70-400 mg/dL

 **Abnormal Range:** 40-69 mg/dL or 401-700 mg/dL

 **Critical Range:** <40 mg/dL or >700 mg/dL

 **Body System:** Immune

 **Function:** Protects mucosal surfaces (respiratory, gastrointestinal, urogenital tracts)

#### Implications of Abnormal Results:

 **Elevated:** IgA nephropathy, liver disease, chronic infections, autoimmune conditions

 **Decreased:** Selective IgA deficiency, combined immunodeficiency, protein-losing conditions

#### Health Improvement Strategies:

 Supporting mucosal immunity (probiotics, vitamin A, zinc)  Infection prevention strategies for deficiency

 Monitoring for associated autoimmune conditions

 Avoiding blood products containing IgA for those with severe deficiency

### Immunoglobulin E (IgE)

 **Normal Range:** <100 IU/mL

 **Abnormal Range:** 100-300 IU/mL

 **Critical Range:** >300 IU/mL

 **Body System:** Immune

 **Function:** Involved in allergic responses and parasite defense

#### Implications of Abnormal Results:

 **Elevated:** Allergies, asthma, atopic dermatitis, parasitic infections, certain immunodeficiencies

#### Health Improvement Strategies:

 Allergen identification and avoidance  Anti-inflammatory diet

 Omega-3 fatty acids

 Vitamin D optimization

 Probiotics for specific conditions  Stress management

 Appropriate medication for allergic conditions

## Autoimmune Markers

### Antinuclear Antibody (ANA)

 **Normal Range:** Negative or <1:40 titer

 **Abnormal Range:** 1:40-1:80 titer

 **Critical Range:** >1:80 titer

 **Body System:** Immune

 **Function:** Antibody directed against cell nuclei; marker for autoimmune conditions

#### Implications of Abnormal Results:

 **Positive:** Systemic lupus erythematosus, Sjögren's syndrome, scleroderma, mixed connective tissue disease, rheumatoid arthritis, normal aging

#### Health Improvement Strategies:

 Anti-inflammatory diet  Vitamin D optimization  Omega-3 fatty acids

 Sun protection for photosensitive conditions  Stress management

 Regular physical activity

 Adequate sleep

 Smoking cessation

### Rheumatoid Factor (RF)

 **Normal Range:** <14 IU/mL

 **Abnormal Range:** 14-70 IU/mL

 **Critical Range:** >70 IU/mL

 **Body System:** Immune/Musculoskeletal

 **Function:** Antibody against the Fc portion of IgG; associated with rheumatoid arthritis

#### Implications of Abnormal Results:

 **Positive:** Rheumatoid arthritis, Sjögren's syndrome, systemic lupus erythematosus, mixed cryoglobulinemia, chronic infections

#### Health Improvement Strategies:

 Anti-inflammatory diet rich in omega-3 fatty acids  Weight management

 Regular physical activity and joint-specific exercises  Stress reduction

 Early intervention with disease-modifying treatments  Smoking cessation (strong association with RA)

## Cellular Immunity

### CD4+ T Cell Count

 **Normal Range:** 500-1,500 cells/μL  **Abnormal Range:** 200-499 cells/μL  **Critical Range:** <200 cells/μL

 **Body System:** Immune

 **Function:** Helper T cells that coordinate immune response; critical for defense against intracellular pathogens

#### Implications of Abnormal Results:

 **Decreased:** HIV infection, medications (corticosteroids), malnutrition, stress, aging

#### Health Improvement Strategies:

 HIV prevention strategies

 Antiretroviral therapy adherence if HIV-positive  Adequate nutrition with complete protein

 Stress management  Regular exercise

 Adequate sleep

 Optimizing vitamin D status

 Infection prevention strategies

### Natural Killer (NK) Cell Count

 **Normal Range:** 70-430 cells/μL  **Abnormal Range:** 30-69 cells/μL  **Critical Range:** <30 cells/μL

 **Body System:** Immune

 **Function:** Innate immune cells that kill virus-infected and cancer cells without prior sensitization

#### Implications of Abnormal Results:

 **Decreased:** Viral infections, certain cancers, autoimmune diseases, chronic fatigue, aging

#### Health Improvement Strategies:

 Regular exercise (particularly moderate intensity)  Adequate sleep (7-9 hours)

 Stress management

 Mushroom extracts (particularly shiitake, maitake, reishi)  Adequate zinc and selenium

 Vitamin D optimization

 Limiting alcohol consumption

# NERVOUS SYSTEM TESTS

## Cerebrospinal Fluid Analysis

### CSF Protein

 **Normal Range:** 15-45 mg/dL

 **Abnormal Range:** 46-100 mg/dL

 **Critical Range:** >100 mg/dL

 **Body System:** Nervous

 **Function:** Reflects blood-brain barrier integrity and intrathecal antibody production

#### Implications of Abnormal Results:

 **Elevated:** Infections (meningitis, encephalitis), multiple sclerosis, Guillain-Barré syndrome, tumors, subarachnoid hemorrhage, diabetic neuropathy

#### Health Improvement Strategies:

 Treatment specific to underlying condition

 Anti-inflammatory approaches for certain conditions  Blood sugar control for diabetic patients

 Appropriate antimicrobial therapy for infections

 Immunomodulatory treatments for autoimmune conditions

### CSF Glucose

 **Normal Range:** 50-80 mg/dL (2/3 of blood glucose)

 **Abnormal Range:** 30-49 mg/dL

 **Critical Range:** <30 mg/dL

 **Body System:** Nervous

 **Function:** Reflects glucose transport across blood-brain barrier and consumption by brain and pathogens

#### Implications of Abnormal Results:

 **Decreased:** Bacterial meningitis, fungal meningitis, tuberculosis meningitis, carcinomatous meningitis

#### Health Improvement Strategies:

 Prompt antimicrobial therapy for infections  Supportive care

 Managing increased intracranial pressure when present

### CSF Cell Count

 **Normal Range:** 0-5 WBC/μL

 **Abnormal Range:** 6-100 WBC/μL

 **Critical Range:** >100 WBC/μL

 **Body System:** Nervous

 **Function:** Indicates presence of infection, inflammation, or malignancy in central nervous system

#### Implications of Abnormal Results:

 **Elevated:** Infections, inflammatory conditions, subarachnoid hemorrhage, multiple sclerosis, malignancy

 **Differential patterns:** Neutrophils predominate in bacterial infections; lymphocytes in viral and TB

#### Health Improvement Strategies:

 Diagnosis-specific treatment

 Appropriate antimicrobial therapy for infections  Anti-inflammatory treatments when indicated

 Regular monitoring in chronic conditions

## Neurological Biomarkers

### Tau Protein and Phosphorylated Tau (CSF)

 **Tau Normal Range:** <400 pg/mL

 **Tau Abnormal Range:** 400-600 pg/mL

 **Tau Critical Range:** >600 pg/mL

 **P-Tau Normal Range:** <60 pg/mL

 **P-Tau Abnormal Range:** 60-80 pg/mL

 **P-Tau Critical Range:** >80 pg/mL

 **Body System:** Nervous

 **Function:** Stabilizes microtubules in neurons; phosphorylated tau contributes to neurofibrillary tangles

#### Implications of Abnormal Results:

 **Elevated:** Alzheimer's disease, chronic traumatic encephalopathy, frontotemporal dementia, brain injury

#### Health Improvement Strategies:

 Cognitive stimulation activities  Regular physical exercise

 Mediterranean or MIND diet  Social engagement

 Adequate sleep

 Blood pressure control  Diabetes management  Avoiding head injuries  Smoking cessation

### Beta-Amyloid 42 (CSF)

 **Normal Range:** >500 pg/mL

 **Abnormal Range:** 300-500 pg/mL

 **Critical Range:** <300 pg/mL

 **Body System:** Nervous

 **Function:** Protein fragment that can form plaques in Alzheimer's disease

#### Implications of Abnormal Results:

 **Decreased in CSF:** Alzheimer's disease (indicates retention in brain as plaques)

#### Health Improvement Strategies:

 Similar to tau protein strategies

 Maintaining cardiovascular health

 Cognitive reserve building through education and mental activity  Potential benefit from curcumin supplementation

 Optimizing sleep quality

### BDNF (Brain-Derived Neurotrophic Factor)

 **Normal Range:** 14-42 ng/mL  **Abnormal Range:** 8-13 ng/mL  **Critical Range:** <8 ng/mL

 **Body System:** Nervous

 **Function:** Growth factor supporting neuronal health, survival, and plasticity

#### Implications of Abnormal Results:

 **Decreased:** Depression, neurodegenerative diseases, cognitive impairment, schizophrenia

#### Health Improvement Strategies:

 Regular aerobic exercise (strongest intervention)  Cognitive stimulation

 Social interaction

 Omega-3 fatty acids

 Caloric restriction or intermittent fasting  Stress management

 Adequate sleep

 Meditation practices

## Neurotransmitters and Metabolites

### Serotonin (Blood) and 5-HIAA (Urine)

 **Serotonin Normal Range:** 50-220 ng/mL

 **Serotonin Abnormal Range:** 20-49 ng/mL or 221-300 ng/mL

 **Serotonin Critical Range:** <20 ng/mL or >300 ng/mL

 **5-HIAA Normal Range:** 2-6 mg/24h

 **Body System:** Nervous

 **Function:** Neurotransmitter affecting mood, sleep, appetite, pain perception; 5-HIAA is its metabolite

#### Implications of Abnormal Results:

 **Elevated:** Carcinoid syndrome, certain medications, dietary factors

 **Decreased:** Depression, anxiety, insomnia, fibromyalgia

#### Health Improvement Strategies:

 Tryptophan-rich foods (eggs, cheese, tofu, salmon, turkey, nuts)  Regular physical exercise

 Light therapy for seasonal affective disorder  Stress management techniques

 Regular sleep schedule

 Limiting alcohol consumption  Mindfulness practices

### Dopamine (Urine) and HVA (Urine)

 **Dopamine Normal Range:** 65-400 μg/24h

 **Dopamine Abnormal Range:** 30-64 μg/24h or 401-600 μg/24h

 **Dopamine Critical Range:** <30 μg/24h or >600 μg/24h

 **HVA Normal Range:** 1.5-7.5 mg/24h

 **Body System:** Nervous

 **Function:** Neurotransmitter affecting movement, motivation, reward, pleasure; HVA is its metabolite

#### Implications of Abnormal Results:

 **Elevated:** Pheochromocytoma, neuroblastoma, stress, certain medications

 **Decreased:** Parkinson's disease, depression, addiction disorders

#### Health Improvement Strategies:

 Tyrosine-rich foods (meat, dairy, nuts, legumes)  Regular physical exercise

 Adequate sleep

 Stress management  Exposure to sunlight

 Reducing sugar intake  Mindfulness practices

 Engaging in rewarding activities

### GABA (Plasma)

 **Normal Range:** 50-150 pmol/mL

 **Abnormal Range:** 20-49 pmol/mL or 151-200 pmol/mL

 **Critical Range:** <20 pmol/mL or >200 pmol/mL

 **Body System:** Nervous

 **Function:** Primary inhibitory neurotransmitter; balances excitatory activity

#### Implications of Abnormal Results:

 **Decreased:** Anxiety disorders, insomnia, epilepsy, movement disorders

#### Health Improvement Strategies:

 Stress reduction techniques  Regular physical activity

 Meditation and mindfulness  Adequate sleep hygiene

 Magnesium-rich foods

 Limited caffeine and alcohol

 Specific supplements if recommended (L-theanine, magnesium)

# MUSCULOSKELETAL SYSTEM TESTS

## Bone Metabolism

### Calcium

 **Normal Range:** 8.5-10.5 mg/dL

 **Abnormal Range:** 7.5-8.4 mg/dL or 10.6-12.0 mg/dL

 **Critical Range:** <7.5 mg/dL or >12.0 mg/dL

 **Body System:** Musculoskeletal/Endocrine

 **Function:** Essential for bone structure, muscle contraction, nerve transmission, blood clotting

#### Implications of Abnormal Results:

 **Elevated (Hypercalcemia):** Hyperparathyroidism, malignancy, excess vitamin D, thiazide diuretics, sarcoidosis

 **Decreased (Hypocalcemia):** Hypoparathyroidism, vitamin D deficiency, kidney failure, pancreatitis, certain medications

#### Health Improvement Strategies:

 Calcium-rich foods (dairy, fortified plant milks, leafy greens)  Vitamin D adequacy for absorption

 Weight-bearing exercise

 Avoiding excessive phosphorus intake (soft drinks)  Limiting sodium intake

 Monitoring when on certain medications

### Vitamin D (25-Hydroxyvitamin D)

 **Normal Range:** 30-100 ng/mL  **Abnormal Range:** 20-29 ng/mL  **Critical Range:** <20 ng/mL

 **Body System:** Musculoskeletal/Endocrine

 **Function:** Essential for calcium absorption and bone mineralization; regulates immune function

#### Implications of Abnormal Results:

 **Decreased:** Osteomalacia, rickets, increased fracture risk, muscle weakness, immune dysfunction

#### Health Improvement Strategies:

 Sun exposure (10-30 minutes several times weekly)

 Vitamin D-rich foods (fatty fish, egg yolks, fortified foods)

 Supplementation when indicated (typically 1000-2000 IU daily)  Weight management (obesity reduces vitamin D levels)

 Regular testing for high-risk individuals

### Parathyroid Hormone (PTH)

 **Normal Range:** 15-65 pg/mL

 **Abnormal Range:** 66-100 pg/mL or 10-14 pg/mL

 **Critical Range:** >100 pg/mL or <10 pg/mL

 **Body System:** Musculoskeletal/Endocrine

 **Function:** Regulates calcium and phosphorus levels; stimulates bone resorption

#### Implications of Abnormal Results:

 **Elevated:** Primary hyperparathyroidism, secondary hyperparathyroidism (kidney disease), vitamin D deficiency

 **Decreased:** Hypoparathyroidism, hypercalcemia, excess vitamin D

#### Health Improvement Strategies:

 Adequate vitamin D status  Appropriate calcium intake  Kidney health maintenance

 Surgical intervention for primary hyperparathyroidism when indicated  Phosphate binders for kidney patients when prescribed

### Bone Turnover Markers (N-telopeptide, C-telopeptide, Osteocalcin)

 **N-telopeptide Normal Range:** Females: 5-65 nM BCE/mM Cr, Males: 3-51 nM BCE/mM Cr

 **C-telopeptide Normal Range:** 100-700 pg/mL (premenopausal), 104-1008 pg/mL (male)

 **Osteocalcin Normal Range:** 11-50 ng/mL

 **Body System:** Musculoskeletal

 **Function:** Reflect rate of bone formation and resorption; assess response to treatment

#### Implications of Abnormal Results:

 **Elevated Resorption Markers:** Osteoporosis, Paget's disease, metastatic bone disease, hyperparathyroidism

 **Elevated Formation Markers:** Growing children, fracture healing, Paget's disease

#### Health Improvement Strategies:

 Weight-bearing and resistance exercise  Adequate calcium and vitamin D

 Protein adequacy (0.8-1.0 g/kg/day)  Fall prevention strategies

 Limiting alcohol and avoiding smoking

 Appropriate osteoporosis medication when prescribed

## Muscle Function

### Creatine Kinase (CK)

 **Normal Range:** Males: 39-308 U/L, Females: 26-192 U/L

 **Abnormal Range:** Males: 309-1,000 U/L, Females: 193-1,000 U/L

 **Critical Range:** >1,000 U/L

 **Body System:** Musculoskeletal

 **Function:** Enzyme found in muscle tissues; released when muscle is damaged

#### Implications of Abnormal Results:

 **Elevated:** Muscle trauma, intense exercise, rhabdomyolysis, muscular dystrophies, myocardial infarction, statins

#### Health Improvement Strategies:

 Proper exercise progression (gradual increase)  Adequate hydration

 Electrolyte balance

 Statin dose adjustment when needed

 Coenzyme Q10 supplementation for statin users (when recommended)  Proper technique during physical activities

 Adequate recovery between workouts

### Myoglobin

 **Normal Range:** Males: 28-72 ng/mL, Females: 25-58 ng/mL

 **Abnormal Range:** 73-150 ng/mL, 59-150 ng/mL

 **Critical Range:** >150 ng/mL

 **Body System:** Musculoskeletal/Cardiovascular

**Function:** Oxygen-binding protein in muscle; released quickly after muscle damage

#### Implications of Abnormal Results:

 **Elevated:** Muscle trauma, rhabdomyolysis, myocardial infarction, vigorous exercise, kidney failure

#### Health Improvement Strategies:

 Similar to CK strategies

 Adequate hydration especially important to protect kidneys  Monitoring kidney function if myoglobin elevated

 Avoiding excessive muscle strain

# GENETIC AND GENOMIC TESTS

## Basic Genetic Tests

### Karyotype

 **Normal Range:** 46,XX (female) or 46,XY (male)

 **Abnormal Range:** Numerical or structural abnormalities

 **Critical Range:** Major chromosomal abnormalities

 **Body System:** Multiple

 **Function:** Examines number and structure of chromosomes; detects large genetic abnormalities

#### Implications of Abnormal Results:

 **Abnormal:** Down syndrome (trisomy 21), Turner syndrome (45,X), Klinefelter syndrome (47,XXY), other chromosomal disorders

#### Health Improvement Strategies:

 Genetic counseling

 Condition-specific management  Early intervention services

 Educational support

 Regular screening for associated health issues  Family planning considerations

### Pharmacogenomic Testing

 **Normal Range:** Normal metabolism

 **Abnormal Range:** Intermediate metabolism

 **Critical Range:** Poor or ultrarapid metabolism

 **Body System:** Multiple

 **Function:** Examines genes affecting drug metabolism; guides medication selection and dosing

#### Implications of Abnormal Results:

 **Poor Metabolizers:** Higher drug levels, increased side effects, toxicity risk

 **Ultrarapid Metabolizers:** Lower drug levels, reduced efficacy, breakthrough symptoms

#### Health Improvement Strategies:

 Medication selection based on genetic profile

 Dose adjustments guided by metabolism status  Avoiding problematic medications

 Regular monitoring when on medications

 Informing all healthcare providers of genetic status  Medical alert bracelet for critical interactions

## Specific Genetic Markers

### BRCA1/BRCA2

 **Normal Range:** No pathogenic variants

 **Abnormal Range:** Variants of uncertain significance

 **Critical Range:** Pathogenic variants

 **Body System:** Reproductive

 **Function:** Tumor suppressor genes; maintain genomic stability; repair DNA

#### Implications of Abnormal Results:

 **Pathogenic Variants:** Significantly increased risk for breast, ovarian, prostate, and pancreatic cancers

#### Health Improvement Strategies:

 Enhanced screening protocols  Prophylactic surgery options

 Chemoprevention when appropriate

 Lifestyle modifications (exercise, limited alcohol)  Healthy weight maintenance

 Regular self-exams

 Genetic counseling for family members

### ApoE Genotype

 **Normal Range:** E3/E3

 **Abnormal Range:** E2/E3, E3/E4

 **Critical Range:** E4/E4

 **Body System:** Cardiovascular/Nervous

 **Function:** Influences lipid metabolism and Alzheimer's risk; E4 allele increases risk

#### Implications of Abnormal Results:

 **E4 Carriers:** Increased risk of Alzheimer's disease, cardiovascular disease

 **E2 Carriers:** Lower Alzheimer's risk, potential increased risk for type III hyperlipoproteinemia

#### Health Improvement Strategies:

 Brain-healthy lifestyle (cognitive stimulation, physical activity)  MIND or Mediterranean diet

 Cardiovascular risk factor management  Regular exercise

 Adequate sleep

 Stress management  Social engagement

 Blood pressure control

## Advanced Genomic Markers

### Telomere Length

 **Normal Range:** Age appropriate

 **Abnormal Range:** Shorter than expected for age  **Critical Range:** Significantly shorter than expected  **Body System:** Multiple

 **Function:** Protective DNA caps that shorten with cell division; biological aging marker

#### Implications of Abnormal Results:

 **Shortened:** Cellular aging, increased risk for age-related diseases, cancer, cardiovascular disease

#### Health Improvement Strategies:

 Regular physical exercise

 Stress management  Mediterranean diet

 Adequate sleep (7-9 hours)  Social connections

 Limiting alcohol

 Avoiding smoking

 Maintaining healthy weight

### DNA Methylation Age

 **Normal Range:** Chronological age ±5 years

 **Abnormal Range:** 6-10 years above chronological

 **Critical Range:** >10 years above chronological

 **Body System:** Multiple

 **Function:** Epigenetic modifications affecting gene expression; biological age marker

#### Implications of Abnormal Results:

 **Accelerated:** Increased all-cause mortality risk, age-related disease risk

#### Health Improvement Strategies:

 Anti-inflammatory diet  Regular physical activity  Stress reduction

 Adequate sleep

 Maintaining healthy weight  Limiting alcohol

 Avoiding smoking

 Pollutant exposure reduction

# TOXICOLOGY AND ENVIRONMENTAL TESTS

## Heavy Metals

### Lead

 **Normal Range:** <5 μg/dL

 **Abnormal Range:** 5-70 μg/dL

 **Critical Range:** >70 μg/dL

 **Body System:** Nervous/Hematologic

 **Function:** Toxic metal with no physiological function; accumulates in blood, bone, and soft tissues

#### Implications of Abnormal Results:

 **Elevated:** Neurodevelopmental effects in children, hypertension, kidney damage, anemia, reproductive effects

#### Health Improvement Strategies:

 Testing older homes for lead paint  Water filtration if needed

 Regular hand washing  Proper food washing  Dust control in homes

 Calcium, iron, and vitamin C adequacy (reduce absorption)  Chelation therapy for high levels (medical supervision)

### Mercury

 **Normal Range:** <10 μg/L

 **Abnormal Range:** 10-50 μg/L

 **Critical Range:** >50 μg/L

 **Body System:** Nervous/Renal

 **Function:** Toxic metal with no physiological function; different forms (elemental, inorganic, methyl) affect different systems

#### Implications of Abnormal Results:

 **Elevated:** Neurological symptoms, kidney damage, developmental delays in children

#### Health Improvement Strategies:

 Limiting high-mercury fish (shark, swordfish, king mackerel, tilefish)  Choosing low-mercury seafood (salmon, sardines, trout)

 Proper handling of mercury-containing items  Avoiding mercury in occupational settings

 Consider alternative dental materials

 Selenium-rich foods (may counter mercury toxicity)

## Detoxification Capacity

### Glutathione

 **Normal Range:** 3.8-5.5 μmol/L

 **Abnormal Range:** 2.0-3.7 μmol/L

 **Critical Range:** <2.0 μmol/L

 **Body System:** Multiple

 **Function:** Master antioxidant; critical for detoxification; protects cells from oxidative damage

#### Implications of Abnormal Results:

 **Decreased:** Increased oxidative stress, impaired detoxification, chronic diseases, aging

#### Health Improvement Strategies:

 Sulfur-rich foods (garlic, onions, cruciferous vegetables)  NAC supplementation if recommended

 Adequate selenium and glycine  Exercise (moderate intensity)

 Limiting alcohol  Adequate sleep

 Reducing environmental toxin exposure

### Phase I/II Enzyme Function

 **Normal Range:** Normal activity

 **Abnormal Range:** Reduced activity

 **Critical Range:** Significantly reduced activity

 **Body System:** Hepatic

 **Function:** Enzymes that transform toxins for elimination; two-phase process

#### Implications of Abnormal Results:

 **Reduced:** Impaired detoxification, increased sensitivity to medications/toxins, chronic disease risk

#### Health Improvement Strategies:

 Cruciferous vegetables (broccoli, cauliflower, kale)

 Polyphenol-rich foods (berries, grapes, dark chocolate)  Adequate protein intake

 Reducing toxin exposure

Green tea Turmeric/curcumin Garlic and onions Clean water sources

# ADDITIONAL KEY TESTS

## Nutrient Status

### Omega-3 Index

 **Normal Range:** >8%

 **Abnormal Range:** 4-8%

#### Critical Range: <4%

 **Body System:** Cardiovascular

 **Function:** Measures EPA and DHA in red blood cell membranes; reflects tissue levels

#### Implications of Abnormal Results:

 **Decreased:** Increased cardiovascular risk, potential inflammatory conditions, cognitive effects

#### Health Improvement Strategies:

 Fatty fish 2-3 times weekly (salmon, sardines, mackerel)  Fish oil or algae-based omega-3 supplements

 Minimizing omega-6 to omega-3 ratio  Limiting processed foods

 Flaxseed, walnuts, chia seeds (ALA sources)  Monitoring oxidation of supplements

### Zinc

 **Normal Range:** 70-120 μg/dL  **Abnormal Range:** 50-69 μg/dL  **Critical Range:** <50 μg/dL

 **Body System:** Multiple

 **Function:** Essential for immune function, wound healing, DNA synthesis, growth, taste

#### Implications of Abnormal Results:

 **Decreased:** Impaired immunity, poor wound healing, hair loss, taste alterations, growth retardation

#### Health Improvement Strategies:

 Zinc-rich foods (oysters, beef, crab, fortified cereals, legumes)  Supplementation when indicated

 Limiting phytate intake with zinc-containing meals  Addressing malabsorption issues

 Managing chronic diarrhea

 Reasonable doses to avoid copper depletion

### Magnesium

 **Normal Range:** 1.7-2.2 mg/dL

 **Abnormal Range:** 1.2-1.6 mg/dL

 **Critical Range:** <1.2 mg/dL

 **Body System:** Multiple

 **Function:** Required for over 300 enzyme systems; critical for energy production, nerve function, muscle contraction

#### Implications of Abnormal Results:

 **Decreased:** Muscle cramps, arrhythmias, osteoporosis, hypertension, insulin resistance, migraine

#### Health Improvement Strategies:

 Magnesium-rich foods (leafy greens, nuts, seeds, whole grains)  Limiting alcohol consumption

 Managing chronic stress

 Addressing digestive disorders

 Supplementation when indicated (various forms have different bioavailability)  Reducing soda consumption (phosphates deplete magnesium)

**Aging and Longevity Markers Advanced Glycation End Products (AGEs) ** **Normal Range:** Age appropriate

 **Abnormal Range:** Moderately elevated

 **Critical Range:** Significantly elevated

 **Body System:** Multiple

 **Function:** Harmful compounds formed when sugars bind to proteins; contribute to aging and disease

#### Implications of Abnormal Results:

 **Elevated:** Accelerated aging, diabetes complications, cardiovascular disease, neurodegenerative diseases

#### Health Improvement Strategies:

 Low-glycemic diet

 Limiting high-heat cooking methods  Avoiding processed foods

 Regular physical activity  Adequate hydration

 Antioxidant-rich foods

 AGE-inhibiting spices (turmeric, cinnamon, cloves)  Blood sugar control

### NAD+ (Nicotinamide Adenine Dinucleotide)

 **Normal Range:** >20 μmol/L

 **Abnormal Range:** 15-20 μmol/L

 **Critical Range:** <15 μmol/L

 **Body System:** Multiple

 **Function:** Critical coenzyme for metabolism and cellular energy; involved in DNA repair and signaling

#### Implications of Abnormal Results:

 **Decreased:** Associated with aging, metabolic dysfunction, reduced cellular energy

#### Health Improvement Strategies:

 Regular exercise

 Intermittent fasting or caloric restriction

 NAD+ precursors (NMN, NR) when recommended  Limiting alcohol consumption

 Adequate sleep

 Reducing sunburn/UV damage

 Tryptophan and niacin-rich foods

# PERSONALIZED HEALTH STRATEGIES BASED ON LABORATORY RESULTS

## Cardiovascular Risk Optimization

### Strategy for Dyslipidemia

#### Dietary Approach:

 Mediterranean diet pattern

 Plant sterols/stanols (2g daily)  Soluble fiber (10-25g daily)

 Omega-3 fatty acids (2-4g EPA/DHA daily)  Limited saturated fat (<7% of calories)

 No trans fats

 Limited added sugars

#### Physical Activity:

 150+ minutes weekly moderate aerobic activity  2-3 sessions weekly resistance training

 Reducing sedentary time with movement breaks

#### Weight Management:

 Achieving and maintaining healthy BMI

 Focus on waist circumference (<40" men, <35" women)  Sustainable approach to weight loss if needed

#### Additional Lifestyle Factors:

 Smoking cessation  Limiting alcohol

 Stress management  Adequate sleep

#### Supplement Considerations:

 Plant sterols/stanols

 Red yeast rice (when recommended)  Berberine (when recommended)

 Omega-3 supplements

 Coenzyme Q10 for statin users

#### Monitoring:

 Regular lipid panels

 hs-CRP to assess inflammation

 Apolipoprotein testing when indicated

### Strategy for Hypertension

#### Dietary Approach:

 DASH diet pattern

 Sodium limitation (<2,300mg/day, ideally <1,500mg)  Adequate potassium (4,700mg/day)

 Limited alcohol

 Caffeine moderation

#### Physical Activity:

 Regular aerobic activity (30+ minutes daily)  Isometric handgrip exercises

 Consistency more important than intensity

#### Weight Management:

 5-10% weight loss can significantly reduce BP  Focusing on abdominal obesity

#### Additional Lifestyle Factors:

 Stress management (meditation, deep breathing)  Adequate sleep

 Smoking cessation

 Limited NSAIDs and decongestants

#### Supplement Considerations:

 Magnesium (when indicated)  CoQ10 (when indicated)

 Garlic extract

 Potassium (if dietary intake inadequate)

#### Monitoring:

 Home blood pressure monitoring

 Ambulatory monitoring when indicated  Regular professional measurement

 Medication adjustment as needed

## Metabolic Health Optimization

### Strategy for Insulin Resistance/Prediabetes

#### Dietary Approach:

 Low glycemic load pattern

 Adequate fiber (25-35g daily)  Limited refined carbohydrates

 Moderate protein (20-30% of calories)  Healthy fats

 Timed carbohydrate intake

#### Physical Activity:

 150+ minutes weekly moderate activity  Resistance training 2-3 times weekly

 High-intensity interval training when appropriate  Post-meal walking

#### Weight Management:

 5-7% weight loss can prevent diabetes progression  Focus on visceral fat reduction

#### Sleep and Stress:

 7-9 hours quality sleep

 Stress management techniques  Treating sleep apnea if present

#### Supplement Considerations:

 Berberine

 Alpha-lipoic acid  Magnesium

 Chromium

 Vitamin D optimization

#### Monitoring:

 Regular HbA1c  Fasting glucose

 Post-meal glucose when possible  HOMA-IR assessment

### Strategy for Fatty Liver/Elevated Liver Enzymes

#### Dietary Approach:

 Mediterranean pattern

 Limited fructose (especially from beverages)  Adequate choline

 Coffee consumption (protective)  Limited alcohol

#### Physical Activity:

 Regular aerobic exercise  Resistance training

 Reducing sedentary time

#### Weight Management:

 Gradual weight loss (1-2 pounds weekly)  Avoiding rapid weight loss

#### Additional Lifestyle Factors:

 Avoiding hepatotoxic medications  Limited alcohol or abstinence

 Adequate sleep

#### Supplement Considerations:

 Vitamin E (under medical supervision)  Milk thistle

 Phosphatidylcholine  Berberine

#### Monitoring:

 Regular liver enzyme tests  Ultrasound when indicated

Fibrosis assessment