

Laboratory Reference Ranges

Reference ranges vary among laboratories. The listed reference ranges should be used when interpreting laboratory values presented in ESAP™. Conventional units are listed first with SI units in parentheses.

Lipid Values

High-density lipoprotein (HDL) cholesterol	
Optimal-----	>60 mg/dL (>1.55 mmol/L)
Normal-----	40-60 mg/dL (1.04-1.55 mmol/L)
Low-----	<40 mg/dL (<1.04 mmol/L)
Low-density lipoprotein (LDL) cholesterol	
Optimal-----	<100 mg/dL (<2.59 mmol/L)
Low-----	100-129 mg/dL (2.59-3.34 mmol/L)
Borderline-high-----	130-159 mg/dL (3.37-4.12 mmol/L)
High-----	160-189 mg/dL (4.14-4.90 mmol/L)
Very high-----	≥190 mg/dL (≥4.92 mmol/L)
Non-HDL cholesterol	
Optimal-----	<130 mg/dL (<3.37 mmol/L)
Borderline-high-----	130-159 mg/dL (3.37-4.12 mmol/L)
High-----	≥240 mg/dL (≥6.22 mmol/L)
Total cholesterol	
Optimal-----	<200 mg/dL (<5.18 mmol/L)
Borderline-high-----	200-239 mg/dL (5.18-6.19 mmol/L)
High-----	≥240 mg/dL (≥6.22 mmol/L)
Triglycerides	
Optimal-----	<150 mg/dL (<3.88 mmol/L)
Borderline-high-----	150-199 mg/dL (3.88-5.15 mmol/L)
High-----	200-499 mg/dL (5.18-12.92 mmol/L)
Very high-----	≥500 mg/dL (≥12.95 mmol/L)
Lipoprotein (a)-----	≤30 mg/dL (≤1.07 μmol/L)
Apolipoprotein B-----	50-110 mg/dL (0.5-1.1 g/L)

Hematologic Values

Erythrocyte sedimentation rate-----	0-20 mm/h
Haptoglobin-----	30-200 mg/dL (300-2000 mg/L)
Hematocrit-----	41%-50% (0.41-0.51) (male); 35%-45% (0.35-0.45) (female)
Hemoglobin A _{1c} -----	4.7%-5.8% (0.047-0.058)
Hemoglobin-----	14.0-17.5 g/dL
Mean corpuscular volume (MCV)-----	80-100 μm ³ (80-100 fL)
Platelet count-----	150-450 × 10 ³ /μL (150-450 × 10 ⁹ /L)
Protein (total)-----	6.3-7.9 g/dL (63-79 g/L)
Reticulocyte count-----	0.5%-1.5% of red blood cells (0.005-0.015)
White blood cell count-----	4500-11,000/μL (4.5-11.0 × 10 ⁹ /L)

Thyroid Values

Thyroglobulin-----	3-42 ng/mL (3-42 μg/L) (after surgery and radioactive iodine treatment: <1.0 ng/mL [<1.0 μg/L])
Thyroglobulin antibodies-----	≤4.0 IU/mL (≤4.0 kIU/L)
Thyrotropin (TSH)-----	0.5-5.0 mIU/L
Thyroid-stimulating immunoglobulin-----	≤120% of basal activity
Thyropoxidase (TPO) antibodies-----	<2.0 IU/mL (<2.0 kIU/L)
Thyroxine (T ₄) (free)-----	0.8-1.8 ng/dL (10.30-23.17 pmol/L)
Thyroxine (T ₄) (total)-----	5.5-12.5 μg/dL (94.02-213.68 nmol/L)
Free thyroxine (T ₄) index-----	4-12
Triiodothyronine (T ₃) (free)-----	2.3-4.2 pg/mL (3.53-6.45 pmol/L)
Triiodothyronine (T ₃) (total)-----	70-200 ng/dL (1.08-3.08 nmol/L)
Triiodothyronine (T ₃), reverse-----	10-24 ng/dL (0.15-0.37 nmol/L)
Triiodothyronine uptake, resin-----	25%-38%
Radioactive iodine uptake-----	3%-16% (6 hours); 15%-30% (24 hours)

Endocrine Values

Serum

Aldosterone	-----	1-21 ng/dL (27.7-582.5 pmol/L)
Alkaline phosphatase	-----	50-120 U/L (0.84-2.00 μ kat/L)
Androstenedione	-----	65-210 ng/dL (2.27-7.33 nmol/L) (adult male); 80-240 ng/dL (2.79-8.38 nmol/L) (adult female)
Antimullerian hormone	-----	0.7-19.0 ng/mL (5.0-135.7 pmol/L) (male, >12 years); 0.9-9.5 ng/mL (6.4-67.9 pmol/L) (female, 13-45 years); <1.0 ng/mL (<7.1 pmol/L) (female, >45 years)
Calcitonin	-----	<16 pg/mL (<4.67 pmol/L) (basal, male); <8 pg/mL (<2.34 pmol/L) (basal, female); \leq 130 pg/mL (\leq 37.96 pmol/L) (peak calcium infusion, male); \leq 90 pg/mL (\leq 26.28 pmol/L) (peak calcium infusion, female)
Chromogranin A	-----	<93 ng/mL (<93 μ g/L)
Corticosterone	-----	53-1560 ng/dL (1.53-45.08 nmol/L) (>18 years)
Corticotropin (ACTH)	-----	10-60 pg/mL (2.2-13.2 pmol/L)
Cortisol (8 AM)	-----	5-25 μ g/dL (137.9-689.7 nmol/L)
Cortisol (4 PM)	-----	2-14 μ g/dL (55.2-386.2 nmol/L)
Cortisol (salivary), midnight	-----	<0.13 μ g/dL (<3.6 nmol/L)
C-peptide	-----	0.9-4.3 ng/mL (0.30-1.42 nmol/L)
C-reactive protein	-----	0.8-3.1 mg/L (7.62-29.52 nmol/L)
Cross-linked N-telopeptide of type 1 collagen	-----	5.4-24.2 nmol BCE/mmol creat (male); 6.2-19.0 nmol BCE/mmol creat (female)
Dehydroepiandrosterone sulfate (DHEA-S)		
	Female	Male
Age 18-29 years	44-332 μ g/dL (1.19-9.00 μ mol/L)	89-457 μ g.dL (2.41-12.38 μ mol/L)
Age 30-39 years	31-228 μ g/dL (0.84-6.78 μ mol/L)	65-334 μ g/dL (1.76-9.05 μ mol/L)
Age 40-49 years	18-244 μ g/dL (0.49-6.61 μ mol/L)	48-244 μ g/dL (1.30-6.61 μ mol/L)
Age 50-59 years	15-200 μ g/dL (0.41-5.42 μ mol/L)	35-179 μ g/dL (0.95-4.85 μ mol/L)
Age \geq 60 years	15-157 μ g/dL (0.41-4.25 μ mol/L)	25-131 μ g/dL (0.68-3.55 μ mol/L)
Deoxycorticosterone	-----	<10 ng/dL (<0.30 nmol/L) (>18 years)
1,25-Dihydroxyvitamin D ₃	-----	16-65 pg/mL (41.6-169 pmol/L)
Estradiol	-----	10-40 pg/mL (36.7-146.8 pmol/L) (male); 15-350 pg/mL (55.1-1284.8 pmol/L) (premenopausal female*); <10 pg/mL (<36.7 pmol/L) (postmenopausal female) *levels vary widely through menstrual cycle
Estrone	-----	10-60 pg/mL (37.0-221.9 pmol/L) (male); 17-200 pg/mL (62.9-739.6 pmol/L) (premenopausal female); 7-40 pg/mL (25.9-147.9 pmol/L) (postmenopausal female)
α -Fetoprotein	-----	<6 ng/mL (<6 μ g/L)
Follicle-stimulating hormone (FSH)	-----	1.0-13.0 mIU/mL (1.0-13.0 IU/L) (male); <3.0 mIU/mL (<3.0 IU/L) (prepuberty, female); 2.0-12.0 mIU/mL (2.0-12.0 IU/L) (follicular, female); 4.0-36.0 mIU/mL (4.0-36.0 IU/L) (midcycle, female); 1.0-9.0 mIU/mL (1.0-9.0 IU/L) (luteal, female)
Free fatty acids	-----	10.6-18.0 mg/dL (0.4-0.7 nmol/L)
Gastrin	-----	<100 pg/mL (<100 ng/L)
Growth hormone (GH)	-----	0.01-0.97 ng/mL (0.01-0.97 μ g/L) (male); 0.01-3.61 ng/mL (0.01-3.61 μ g/L) (female)
Homocysteine	-----	\leq 1.76 mg/L (\leq 13 μ mol/L)
β -Human chorionic gonadotropin (β -hCG)	-----	<3.0 mIU/mL (<3.0 IU/L) (nonpregnant female)
β -Hydroxybutyrate	-----	<3.0 mg/dL (<300 μ mol/L)
17-Hydroxyprogesterone	-----	29-189 ng/dL (0.87-5.69 nmol/L)
17 α -Hydroxyprogesterone	-----	<220 ng/dL (<6.67 nmol/L) (adult male); <80 ng/dL (<2.42 nmol/L) (follicular, female); <285 ng/dL (<8.64 nmol/L) (luteal, female); <51 ng/dL (1.55 nmol/L) (postmenopausal, female)
25-Hydroxyvitamin D	-----	<10 ng/mL (<25.0 nmol/L) (severe deficiency); 10-24 ng/mL (25.0-59.9 nmol/L) (mild to moderate deficiency); 25-80 ng/mL (62.4-199.7

nmol/L) (optimum levels); >80 ng/mL (>199.7 nmol/L) (toxicity possible)

Inhibin B-----15-300 pg/mL (15-300 ng/L)

Insulinlike growth factor 1 (IGF-1)

	Female	Male
Age 18 years	162-541 ng/mL (21.2-70.9 nmol/L)	170-640 ng/mL (22.3-83.8 nmol/L)
Age 19 years	138-442 ng/mL (18.1-57.9 nmol/L)	147-527 ng/mL (19.3-69.0 nmol/L)
Age 20 years	122-384 ng/mL (16.0-50.3 nmol/L)	132-457 ng/mL (17.3-59.9 nmol/L)
Age 21-25 years	116-341 ng/mL (15.2-44.7 nmol/L)	116-341 ng/mL (15.2-44.7 nmol/L)
Age 26-30 years	117-321 ng/mL (15.3-42.1 nmol/L)	117-321 ng/mL (15.3-42.1 nmol/L)
Age 31-35 years	113-297 ng/mL (14.8-38.9 nmol/L)	113-297 ng/mL (14.8-38.9 nmol/L)
Age 36-40 years	106-277 ng/mL (13.9-36.3 nmol/L)	106-277 ng/mL (13.9-36.3 nmol/L)
Age 41-45 years	98-261 ng/mL (12.8-34.2 nmol/L)	98-261 ng/mL (12.8-34.2 nmol/L)
Age 46-50 years	91-246 ng/mL (11.9-32.2 nmol/L)	91-246 ng/mL (11.9-32.2 nmol/L)
Age 51-55 years	84-233 ng/mL (11.0-30.5 nmol/L)	84-233 ng/mL (11.0-30.5 nmol/L)
Age 56-60 years	78-220 ng/mL (10.2-28.8 nmol/L)	78-220 ng/mL (10.2-28.8 nmol/L)
Age 61-65 years	72-207 ng/mL (9.4-27.1 nmol/L)	72-207 ng/mL (9.4-27.1 nmol/L)
Age 66-70 years	67-195 ng/mL (8.8-25.5 nmol/L)	67-195 ng/mL (8.8-25.5 nmol/L)
Age 71-75 years	62-184 ng/mL (8.1-24.1 nmol/L)	62-184 ng/mL (8.1-24.1 nmol/L)
Age 76-80 years	57-172 ng/mL (7.5-22.5 nmol/L)	57-172 ng/mL (7.5-22.5 nmol/L)
>Age 80 years	53-162 ng/mL (6.9-21.2 nmol/L)	53-162 ng/mL (6.9-21.2 nmol/L)

Insulinlike growth factor binding-----2.5-4.8 mg/L
protein 3

Insulin-----1.4-14.0 μ IU/mL (9.7-97.2 pmol/L)

Islet-cell antibody assay-----0 Juvenile Diabetes Foundation units

Luteinizing hormone (LH)-----1.0-9.0 mIU/mL (1.0-9.0 IU/L) (male); <1.0 mIU/mL (<1.0 IU/L) (prepuberty, female); 1.0-18.0 mIU/mL (1.0-18.0 IU/L) (follicular, female); 20.0-80.0 mIU/mL (20.0-80.0 IU/L) (midcycle, female); 0.5-18.0 mIU/mL (0.5-18.0 IU/L) (luteal, female)

Metanephrines (plasma fractionated)

Metanephrine-----<57 pg/mL (<289 pmol/L)

Normetanephrine-----<148 pg/mL (<808 pmol/L)

75-g oral glucose tolerance test-----60-100 mg/dL (3.3-5.6 mmol/L) (fasting)

Blood glucose values <200 mg/dL (<11.1 mmol/L) (1 hour); <140 mg/dL (7.8 mmol/L) (2 hour) Between 140-200 mg/dL (7.8-11.1 mmol/L) is considered impaired glucose tolerance or prediabetes. Greater than 200 mg/dL (11.1 mmol/L) is a sign of diabetes mellitus

50-g oral glucose tolerance test for-----<140 mg/dL (<7.8 mmol/L) (1 hour)
gestational diabetes

100-g oral glucose tolerance test for-----<95 mg/dL (<5.3 mmol/L) (fasting); <180 mg/dL (<10.0 mmol/L) (1 hour); <155 mg/dL (<8.6 mmol/L) (2 hour); <140 mg/dL (<7.8 mmol/L) (3 hour)
gestational diabetes

Osteocalcin-----9.0-42.0 ng/mL (9.0-42.0 μ g/L)

Parathyroid hormone, intact (PTH)-----10-65 pg/mL (10-65 ng/L)

Parathyroid hormone-related protein-----14-27 pg/mL (14-27 ng/L)
(PTHrP)

Progesterone----- \leq 1.2 ng/mL (\leq 3.8 nmol/L) (male); \leq 1.0 ng/mL (\leq 3.2 nmol/L) (follicular, female); 2.0-20.0 ng/mL (6.4-63.6 nmol/L) (luteal, female); \leq 1.1 ng/mL (\leq 3.5 nmol/L) (postmenopausal, female); >10.0 ng/mL (>31.8 nmol/L) (evidence of ovulatory adequacy)

Proinsulin-----26.5-176.4 pg/mL (3.0-20.0 pmol/L)

Prolactin-----4-23 ng/mL (0.17-1.00 nmol/L) (male); 4-30 ng/mL (0.17-1.30 nmol/L) (female)

Prostate-specific antigen-----<2.0 ng/mL (<2.0 μ g/L) (\leq 40 years); <2.8 ng/mL (<2.8 μ g/L) (\leq 50 years); <3.8 ng/mL (<3.8 μ g/L) (\leq 60 years); <5.3 ng/mL (<5.3 μ g/L) (\leq 70 years); <7.0 ng/mL (<7.0 μ g/L) (\leq 79 years); <7.2 ng/mL (<7.2 μ g/L) (\geq 80 years)

Renin activity, plasma, sodium replete,--0.6-4.3 ng/mL per h
ambulatory

Renin, direct concentration-----	30-40 pg/mL (0.7-1.0 pmol/L)
Sex hormone-binding globulin-----	1.1-6.7 µg/mL (10-60 nmol/L) (male); 2.2-14.6 µg/mL (20-130 nmol/L) (female)
α-Subunit of pituitary glycoprotein hormones-----	<1.2 ng/mL (<1.2 µg/L)
Testosterone (bioavailable) -----	0.8-4.0 ng/dL (0.03-0.14 nmol/L) (20-50 years, female on oral estrogen); 0.8-10.0 ng/dL (0.03-0.35 nmol/L) (20-50 years, female not on oral estrogen); 83.0-257.0 ng/dL (2.88-8.92 nmol/L) (male 20-29 years); 72.0-235.0 ng/dL (2.50-8.15 nmol/L) (male 30-39 years); 61.0-213.0 ng/dL (2.12-7.39 nmol/L) (male 40-49 years); 50.0-190.0 ng/dL (1.74-6.59 nmol/L) (male 50-59 years); 40.0-168.0 ng/dL (1.39-5.83 nmol/L) (male 60-69 years)
Testosterone (free)-----	9.0-30.0 ng/dL (0.31-1.04 nmol/L) (male); 0.3-1.9 ng/dL (0.01-0.07 nmol/L) (female)
Testosterone (total)-----	300-1200 ng/dL (10.4-41.6 nmol/L) (male); 8-60 ng/dL (0.3-2.1 nmol/L) (female)
Vitamin B ₁₂ -----	180-914 pg/mL (180-914 ng/L)

Chemistry Values

Alanine aminotransferase-----	10-40 U/L (0.17-0.67 µkat/L)
Albumin-----	3.5-5.0 g/dL (35-50 g/L)
Aspartate aminotransferase-----	20-48 U/L (0.33-0.80 µkat/L)
Bicarbonate-----	21-28 mEq/L (21-28 mmol/L)
Bilirubin (total)-----	0.3-1.2 mg/dL (5.1-20.5 µmol/L)
Blood gases	
P _{O2} , arterial blood-----	80-100 mm Hg (10.6-13.3 kPa)
P _{CO2} , arterial blood-----	35-45 mm Hg (4.7-6.0 kPa)
Blood pH-----	7.35-7.45
Calcium-----	8.2-10.2 mg/dL (2.1-2.6 mmol/L)
Calcium (ionized)-----	4.60-5.08 mg/dL (1.2-1.3 mmol/L)
Carbon dioxide-----	22-28 mEq/L (22-28 mmol/L)
CD ₄ cell count-----	500-1400/µL (0.5-1.4 x 10 ⁹ /L)
Chloride-----	96-106 mEq/L (96-106 mmol/L)
Creatine kinase-----	50-200 U/L (0.84-3.34 µkat/L)
Creatinine-----	0.6-1.2 mg/dL (53.0-106.1 µmol/L)
Ferritin-----	15-200 ng/mL (33.7-449.4 pmol/L)
Folate-----	≥4.0 ng/mL (≥4.0 µg/L)
Glucose-----	70-110 mg/dL (3.9-6.1 mmol/L)
γ-Glutamyltransferase-----	2-30 U/L (0.03-0.50 µkat/L)
Iron-----	50-150 µg/dL (9.0-26.8 µmol/L) (male); 35-145 µg/dL (6.3-26.0 µmol/L) (female)
Lactate dehydrogenase-----	100-200 U/L (1.7-3.3 µkat/L)
Lactic acid-----	5.4-20.7 mg/dL (0.6-2.3 mmol/L)
Magnesium-----	1.5-2.3 mg/dL (0.6-0.9 mmol/L)
Osmolality-----	275-295 mOsm/kg (275-295 mmol/kg)
Phosphorus-----	2.3-4.7 mg/dL (0.7-1.5 mmol/L)
Potassium-----	3.5-5.0 mEq/L (3.5-5.0 mmol/L)
Prothrombin time-----	8.3-10.8 s
Serum urea nitrogen-----	8-23 mg/dL (2.9-8.2 mmol/L)
Sodium-----	136-142 mEq/L (136-142 mmol/L)
Transferrin saturation-----	14% -50%
Troponin I-----	<0.6 ng/mL (<0.6 µg/L)
Tryptase-----	<11.5 ng/mL (<11.5 µg/L)
Uric acid-----	3.5-7.0 mg/dL (208.2-416.4 µmol/L)

Urine

Albumin-----	30-300 µg/mg creat (3.4-33.9 µg/mol creat)
Albumin to creatinine ratio-----	<30 µg/mg

Aldosterone-----3-20 µg/24 h (8.3-55.4 nmol/d) (should be <12 µg/24 h [<33.2 nmol/d] with oral sodium loading—confirmed with 24-hour urinary sodium >200 mEq)
 Calcium-----20-300 mg/24 h (0.5-7.5 mmol/d)
 Catecholamine fractionation
 Normotensive normal ranges:
 Dopamine-----<700 µg/24 h (<4567 nmol/d)
 Epinephrine-----<35 µg/24 h (<191 nmol/d)
 Norepinephrine-----<170 µg/24 h (<1005 nmol/d)
 Cortisol-----4-50 µg/24 h (11-138 nmol/L)
 Dexamethasone suppression test-----<10 µg/24 h (<27.6 nmol/d)
 (low-dose: 2 day, 2 mg daily),
 urinary free cortisol
 Creatinine-----1.0-2.0 g/24 h (8.8-17.7 mmol/d)
 Glomerular filtration rate (estimated)---->60 mL/min per 1.73 m²
 5-Hydroxyindole acetic acid-----0-6 mg/24 h (0-31.4 µmol/d)
 Iodine (random)----->100 µg/L
 17-Ketosteroids-----6.0-21.0 mg/24 h (20.8-72.9 µmol/d) (male); 4.0-17.0 mg/24 h (13.9-59.0 µmol/d) (female)
 Metanephrine fractionation
 Metanephrine-----<400 µg/24 h (<2028 nmol/d)
 Normetanephrine-----<900 µg/24 h (<4914 nmol/d)
 Total metanephrine-----<1000 µg/24 h (<5260 nmol/d)
 Osmolality-----300-800 mOsm/kg (300-800 mmol/kg)
 Oxalate-----<40 mg/24 h (<456 mmol/d)
 Phosphorus-----0.9-1.3 g/24 h (29.1-42.0 mmol/d)
 Potassium-----17-77 mEq/24 h (17-77 mmol/d)
 Sodium-----40-217 mEq/24 h (40-217 mmol/d)
 Uric acid-----<800 mg/24 h (<4.7 mmol/d)

Other

Semen analysis----->20 million sperm/mL; >50% motility