Laboratory Reference Intervals: Système International (SI) and Traditional Units

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Table 1 provides a summary of selected clinical laboratory reference intervals for adults. For serum drug concentration levels and conversion factors, see the Serum Drug Concentration Monitoring section in Clin Info. The table is not intended to present a comprehensive review or to guide how the tests can be applied clinically. The reference intervals presented are for general informational purposes only. The reader is therefore encouraged to seek additional and confirmatory information. **Reference intervals will vary depending on the analytical methods used and the population studied. Each laboratory establishes its own reference interval for each test.**

Table 1: Adult Laboratory Intervals

Laboratory Test	Reference Intervals		Conversion Factor[a]
	SI Reference	Traditional Reference	
Alanine aminotransferase (ALT) (serum, plasma)			
male	0–1300 nkat/L	0–78 U/L	16.67
female	0–684 nkat/L	0–41 U/L	16.67
Albumin (serum, plasma)	39–53 g/L	3.9–5.3 g/dL	10
Alkaline phosphatase (serum, plasma)[b]	585–2167 nkat/L	35–130 U/L	16.67
Ammonia, as ammonium ion (NH_4^+) (plasma)	11–35 µmol/L	20–60 µg/dL	0.5872
Aspartate aminotransferase (AST) (serum, plasma)			
male	0–900 nkat/L	0–54 U/L	16.67
female	0–567 nkat/L	0–34 U/L	16.67
Bilirubin (serum, plasma)			
total	2–19 µmol/L	0.1–1.1 mg/dL	17.1
conjugated	0–5 µmol/L	0–0.3 mg/dL	17.1
Calcium (serum, plasma)	2.25–2.59 mmol/L	9–10.4 mg/dL	0.2495
Calcium, ionized (blood, serum)	1.15–1.30 mmol/L	2.3–2.6 mEq/L	0.5

Laboratory Test	Reference Intervals		Conversion Factor[a]
	SI Reference	Traditional Reference	
Carbon dioxide (bicarbonate + CO_2) (blood, plasma, serum)	22–30 mmol/L	22–30 mEq/L	1
Chloride (serum, plasma)	102–108 mmol/L	102–108 mEq/L	1
Cholesterol (serum, plasma)			
low-risk populations	<5.2 mmol/L	<200 mg/dL	0.02586
moderate and high-risk populations	<4.2 mmol/L	<162 mg/dL	0.02586
Cortisol (serum, plasma)			
0800–1000 h	138–635 nmol/L	5–23 µg/dL	27.59
1600–1800 h	83–359 nmol/L	3–13 µg/dL	27.59
Cortisol (urine)	30–300 nmol/day	10–110 µg/24 h	2.759
Creatine kinase (CK) (serum, plasma)			
male	0–4000 nkat/L	0–240 U/L	16.67
female	0–3167 nkat/L	0–190 U/L	16.67
Creatinine (serum, plasma)			
male	62–110 µmol/L	0.7–1.2 mg/dL	88.4
female	53–88 µmol/L	0.6–1 mg/dL	88.4
Creatinine clearance	1.24–2.32 mL/s	75–139 mL/min	0.01667
C-reactive protein (CRP) (serum, plasma)	0.1–8.8 mg/L	0.01–0.88 µg/dL	10
Delta 5-aminolevulinic acid (urine)	8–53 µmol/day	1–7 mg/24 h	7.626
Ethanol (plasma)			
legal limit (driving)[c]	<10.86 mmol/L	<50 mg/dL	0.2171

Laboratory Test	Reference Intervals		Conversion Factor[a]
	SI Reference	Traditional Reference	
toxic	>22 mmol/L	>100 mg/dL	0.2171
Ferritin (serum, plasma)			
male	39–439 µg/L	39–439 ng/mL	1
female	6.5–147 µg/L	6.5–147 ng/mL	1
Fibrinogen (plasma)	2–4.2 g/L	200–420 mg/dL	0.01
Folate, as folic acid, pteroylglutamic acid (serum)	≥9 nmol/L	≥4 ng/mL	2.266
Gamma glutamyl transferase (GGT) (serum, plasma)			
male	0–1034 nkat/L	0–62 U/L	16.67
female	0–633 nkat/L	0–38 U/L	16.67
Gases (arterial blood)			
pO_2	11.3–14 kPa	85–105 mm Hg	0.1333
pCO_2	4.7–6 kPa	35–45 mm Hg	0.1333
Glucose (CSF)	2.8–4.4 mmol/L	50–80 mg/dL	0.05551
Glucose, fasting (serum, plasma)	4–6 mmol/L	72–108 mg/dL	0.05551
Hematocrit			
male	0.4–0.5	40–50%	0.01
female	0.35–0.43	35–43%	0.01
Hemoglobin (blood)			
male	136–169 g/L	13.6–16.9 g/dL	10
female	119–148 g/L	11.9–14.8 g/dL	10
Hemoglobin A_{1c}	0.048–0.059	4.8–5.9%	0.01
Insulin, fasting (serum, plasma)	17–156 pmol/L	2.4–21.8 µU/mL	7.175
Iron (serum, plasma)			

Laboratory Test	Reference Intervals		Conversion Factor[a]
	SI Reference	Traditional Reference	
male	14–32 µmol/L	80–180 µg/dL	0.1791
female	11–29 µmol/L	60–160 µg/dL	0.1791
Iron binding capacity (serum, plasma)	45–73 µmol/L	250–408 µg/dL	0.1791
Iron saturation (serum, plasma)	0.2–0.5	20–50%	0.01
Lactate dehydrogenase (LDH)	2000–3667 nkat/L	120–220 U/L	16.67
Lipoproteins, apo B (serum, plasma)	≤0.8 g/L	≤80 mg/dL	0.01
Lipoproteins, high-density (HDL) cholesterol (serum, plasma)	>1.3 mmol/L	>50 mg/dL	0.02586
Lipoproteins, low-density (LDL) cholesterol (serum, plasma)			
low-risk populations	<3.4 mmol/L	<130 mg/dL	0.02586
moderate and high-risk populations	<2 mmol/L	<77 mg/dL	0.02586
Lipoproteins, non-HDL cholesterol (serum, plasma)	≤2.6 mmol/L	≤100 mg/dL	0.02586
Magnesium (serum, plasma)	0.65–1.05 mmol/L	1.58–2.55 mg/dL	0.4114
	0.65–1.05 mmol/L	1.7–2.1 mEq/L	0.5
Mean corpuscular hemoglobin (MCH) (blood)	27–33 pg	27–33 pg	1
Mean corpuscular hemoglobin concentration (MCHC) (blood)	325–352 g/L	32.5–35.2 g/dL	10
Mean corpuscular volume (MCV) (blood)	82–98 fL	82–98 μm^3	1
Methanol (plasma)	0 mmol/L	0 mg/dL	0.3121
Osmolality (serum, plasma)	280–300 mmol/kg	280–300 mOsm/kg	1
Osmolality (urine)	50–1200 mmol/kg	50–1200 mOsm/kg	1
Phosphate, as inorganic phosphorus (serum, plasma)	0.94–1.55 mmol/L	2.9–4.8 mg/dL	0.3229

Laboratory Test	Reference Intervals		Conversion Factor[a]
	SI Reference	Traditional Reference	
Platelet count (blood)	135–400 × 10^9/L	135 000–400 000/mm^3	0.001
Porphobilinogen (urine)	0–8.8 µmol/day	0–2 mg/24 h	4.42
Potassium (serum, plasma)	3.8–5 mmol/L	3.8–5 mEq/L	1
Red cell count, erythrocytes (ERCS)			
male	4.3–5.7 × 10^{12}/L	4.3–5.7 × 10^6/mm^3	1
female	3.8–5 × 10^{12}/L	3.8–5 × 10^6/mm^3	1
Reticulocyte count (blood)	25–75 × 10^9/L	25 000–75 000/mm^3	0.001
Sodium (serum, plasma)	136–143 mmol/L	136–143 mEq/L	1
Thyroid tests (serum, plasma)			
Free thyroxine (free T_4)	12–30 pmol/L	0.9–2.3 ng/dL	12.87
Free triiodothyroxine (free T_3)	3.7–6.5 pmol/L	0.24–0.42 ng/dL	15.4
TSH	0.35–5 mU/L	0.35–5 µU/mL	1
Triglycerides (serum, plasma)			
nonfasting	<2 mmol/L	<177 mg/dL	0.01129
fasting	<1.7 mmol/L	<150 mg/dL	0.01129
Troponin T (serum, plasma)	0–14 ng/L	0–14 pg/mL	1
Urate, as uric acid (serum, plasma)			
male	220–460 µmol/L	3.7–7.7 mg/dL	59.48
female	150–370 µmol/L	2.5–6.2 mg/dL	59.48
Urea (serum, plasma)	2.9–8.6 mmol/L	8–24 mg/dL	0.357[d]
Vitamin B_{12} (serum, plasma)	150–700 pmol/L	200–950 pg/mL	0.7378
Vitamin D (total 25-hydroxy vitamin D) (serum, plasma)	50-250 nmol/L	20–100 ng/mL	2.5

Laboratory Test	Reference Intervals		Conversion Factor[a]
	SI Reference	Traditional Reference	
White cell count, WBC (blood)	3.8–10.4 × 10^9/L	3800–10 400/mm^3	0.001
Zinc (serum)	11.5–18.5 µmol/L	75–120 µg/dL	0.153

[a] To convert from traditional to SI units, multiply the traditional value by the conversion factor. To convert from SI to traditional units, divide the SI value by the conversion factor.

[b] There is a wide range of alkaline phosphatase activities, which are dependent on gender, age and laboratory method.

[c] Varies in different jurisdictions and may also be lower according to the age and experience of the driver.

[d] This conversion factor can also be used to obtain values for urea in mmol/L by multiplying by blood urea nitrogen (BUN) in mg/dL.

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