

Clinical laboratory tests – Adult normal values

This table lists reference values for the interpretation of laboratory results provided in the Medical Council of Canada exams.

All values apply to adults.

Normal values were obtained primarily from the University of Ottawa's laboratory ([Eastern Ontario Regional Laboratory Association \[EORLA\]](#)), the [AMA Manual of Style](#), and [Ottawa Hospital Laboratory Services](#).

Arterial blood gases^a

Clinical laboratory test	Normal value
pH, arterial blood	7.38–7.46
Pco ₂ , arterial blood	32–45 mm Hg
Po ₂ , arterial blood	83–116 mm Hg
Bicarbonate (HCO ₃), arterial blood	22–27 mmol/L
Base excess, arterial blood	–2.5 to 2.5 mmol/L

^aEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Blood Gas & Oximetry. Last updated June 28, 2019.

Blood

Hemogram

Clinical laboratory test	Normal value
Erythrocyte sedimentation rate (ESR), blood ^a	
Female	0–20 mm/h
Male	0–10 mm/h
Hematocrit (Hct), blood ^a	0.38–0.50 L/L
Hemoglobin (Hgb), blood ^a	
Female	115–155 g/L
Male	125–170 g/L
Mean corpuscular volume (MCV), blood ^a	80–100 fL
Mean corpuscular hemoglobin (MCH), blood ^a	
Female	25–34 pg
Male	27–34 pg
Mean corpuscular hemoglobin concentration (MCHC), blood ^a	315–355 g/L
Mean platelet volume (MPV), blood ^a	9.0–14.0 fL

Platelet count, blood ^a	130–380 × 10 ⁹ /L
Red blood cell (RBC) count, blood ^a	
Female	3.50–5.00 × 10 ¹² /L
Male	4.00–5.50 × 10 ¹² /L
Red cell distribution width (RDW), blood ^a	11.5%–15.5%
Reticulocyte count, absolute, blood ^b	23–90 × 10 ⁹ /L
Reticulocyte percentage, blood ^c	0.5%–1.5%

^aEastern Ontario Regional Laboratory Association. Hematology reference ranges. Glengarry Memorial Hospital. Effective date June 25, 2019.

^bFrom The Ottawa Hospital laboratory (2019).

^cSzigeti, R. G. (2014, September 5). Reticulocyte count and reticulocyte hemoglobin content. Retrieved April 27, 2020, from emedicine.medscape.com/article/2086146-overview.

Coagulation (Hemostasis)

Clinical laboratory test	Normal value
Bleeding time (Ivy method), blood ^d	1–9 min
International normalized ratio (INR), nonanticoagulated, blood ^a	0.9–1.2
Activated partial thromboplastin time (APTT), nonanticoagulated, blood ^a	22–30 s
Prothrombin time (PT), blood ^e	10–14 s

^aEastern Ontario Regional Laboratory Association. Hematology reference ranges. Glengarry Memorial Hospital. Effective date June 25, 2019.

^dCharbek, E. (2016, March 2). Bleeding time. Retrieved April 15, 2020, from emedicine.medscape.com/article/2085022-overview.

^eGamma Dynacare.

White blood cells and Differential

Clinical laboratory test	Normal value
White blood cell (WBC) count, blood ^a	3.5–10.5 × 10 ⁹ /L
Neutrophils, absolute, blood ^a	2.0–7.5 × 10 ⁹ /L
Basophils, blood ^a	0–0.1 × 10 ⁹ /L
Eosinophils, blood ^a	0–0.5 × 10 ⁹ /L
Lymphocytes, blood ^a	
Female	0.8–3.3 × 10 ⁹ /L
Male	0.8–3.5 × 10 ⁹ /L
Monocytes, blood ^a	0.1–1.0 × 10 ⁹ /L

^aEastern Ontario Regional Laboratory Association. Hematology reference ranges. Glengarry Memorial Hospital. Effective date June 25, 2019.

Iron studies

Clinical laboratory test	Normal value
Ferritin, blood ^f	
Female	11–307 µg/L
Male	24–336 µg/L
Iron, blood ^g	
Female	9–30 µmol/L
Male	12–31 µmol/L
Iron-binding capacity, total (TIBC), blood ^g	45–81 µmol/L
Transferrin, blood ^g	2.0–3.6 g/L
Transferrin saturation, blood ^e	0.20–0.50

^eGamma Dynacare.

^fEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Beckman DXI. Last updated June 28, 2019.

^gEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Siemens Vista. Last updated June 28, 2019.

Thyroid

Clinical laboratory test	Normal value
Thyroid peroxidase antibody, blood ^h	< 35 IU/mL
Thyrotropin (thyroid-stimulating hormone), blood ^f	0.34–5.60 mIU/L
Thyroxine, free (FT ₄), blood ^f	7.0–17.0 pmol/L
Triiodothyronine, free (FT ₃), blood ^f	3.3–6.0 pmol/L

^fEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Beckman DXI. Last updated June 28, 2019.

^hElhomsy, G. (2014, December 4). Antithyroid antibody. Retrieved April 15, 2020, from <https://emedicine.medscape.com/article/2086819-overview>.

Chemical constituents

Clinical laboratory test	Normal value
Adrenocorticotrophic hormone (ACTH), blood ⁱ	
At 8 a.m.	2.2–13.3 pmol/L
At 4 p.m.	< 4.5 pmol/L
Albumin, blood ^g	34–50 g/L
Aldosterone, blood ^j	61–978 pmol/L
Alkaline phosphatase, blood ^g	50–136 IU/L

Transaminase^g

Alanine aminotransferase (ALT), blood	17–63 IU/L
Aspartate aminotransferase (AST), blood	15–37 IU/L
γ -Glutamyltransferase (GGT), blood	
Female	5.0–55.0 IU/L
Male	15.0–85.0 IU/L
Ammonia, blood ^g	≤ 35 $\mu\text{mol/L}$
Amylase, blood ^g	25–115 IU/L
Anion gap, blood ^g	5–12 mmol/L
Bicarbonate (HCO_3^-), blood ^b	21–32 mmol/L
Bilirubin, blood ^g	
Direct (conjugated)	2–9 $\mu\text{mol/L}$
Total	3–17 $\mu\text{mol/L}$
Brain-type natriuretic peptide (BNP) ^k	
BNP, blood	≤ 50 pg/mL
<i>N</i> -terminal pro-brain-type natriuretic peptide (NT-proBNP), blood	≤ 125 pg/mL

CD4 T-cell count, blood ^l	500–2000 cells/ μ L
C-reactive protein, blood ^g	\leq 10 mg/L
Calcium (Ca), blood	
Total ^g	2.12–2.52 mmol/L
Ionized ^m	1.14–1.28 mmol/L
Cancer antigen (CA) 125, blood ^f	$<$ 35 kIU/L
Cancer antigen (CA) 19-9, blood ^f	$<$ 35 kIU/L
Carbamazepine, blood ⁿ	17–51 μ mol/L
Carcinoembryonic antigen (CEA), blood ^f	$<$ 3.0 μ g/L
Chloride (Cl), blood ^g	98–107 mmol/L
Cortisol, blood ^f	
a.m.	185–624 nmol/L
p.m.	\leq 276 nmol/L
Creatine kinase (CK), blood ^g	
Female	30–190 IU/L
Male	30–250 IU/L

Creatinine, blood ^g	
Female	22–75 µmol/L
Male	49–93 µmol/L
D-dimer, blood ^a	< 600 µg/L
Estimated glomerular filtration rate (eGFR), blood ^b	≥ 60 mL/min/1.73 m ²
α ₁ -Fetoprotein, blood ^f	≤ 9.0 µg/L
Folate (folic acid), blood ^f	≥ 10.0 nmol/L
Glucose, blood ^g	
Fasting	4.0–6.0 mmol/L
Random	4.0–11.0 mmol/L
Hemoglobin A _{1c} (HbA _{1c}), blood ^g	4.8%–6.0%
Hepatitis B surface antibodies, blood ^o	≥ 10 mIU/mL (Positive) < 10 mIU/mL (Negative)
Lactate, blood ^m	0.5–2.5 mmol/L
Lactate dehydrogenase (LDH), blood ^g	100–205 IU/L
Lipase, blood ^g	73–393 IU/L

Lithium (Li), blood ⁿ	
Age 18–65 y	0.6–1.2 mmol/L
Age > 65 y	0.4–0.8 mmol/L
Magnesium (Mg), blood ^g	
0.74–1.03 mmol/L	
Osmolality, blood ^p	
275–295 mmol/kg	
Parathyroid hormone (PTH), blood ^f	
1.6–9.3 pmol/L	
Phosphate (PO ₄), blood ^g	
0.81–1.58 mmol/L	
Potassium (K), blood ^g	
3.5–5.1 mmol/L	
Prostate-specific antigen (PSA), blood ^f	
< 3.1 µg/L	
Protein, total, blood ^q	
Age 18–<30 y	65–83 g/L
Age ≥30 y	65–78 g/L
Rheumatoid factor (RF), blood ^g	
≤ 20 kIU/L	
Sodium (Na), blood ^g	
136–146 mmol/L	
Troponin I, blood ^g	
≤ 45 ng/L	
Troponin T (TnT), blood ^p	
≤ 0.1 µg/L	

Uric acid, blood ^y	
Female	155–400 µmol/L
Male	208–400 µmol/L
Urea, blood ^g	2.1–8.0 mmol/L
Valproic acid, blood ⁿ	350–700 µmol/L
Vitamin B ₁₂ , blood ^f	133–675 pmol/L
Vitamin D (25-hydroxyvitamin D), blood ^f	75–250 nmol/L

^aEastern Ontario Regional Laboratory Association. Hematology reference ranges. Glengarry Memorial Hospital. Effective date June 25, 2019.

^bFrom The Ottawa Hospital laboratory (2019).

^fEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Beckman DXI. Last updated June 28, 2019.

^gEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Siemens Vista. Last updated June 28, 2019.

ⁱNieman, L. K., Lacroix, A., Martin, K. A. (2019, September 9). Measurement of ACTH, CRH, and other hypothalamic and pituitary peptides. Retrieved April 14, 2020, from uptodate.com/contents/measurement-of-acth-crh-and-other-hypothalamic-and-pituitary-peptides.

^jEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Liaison XL. Last updated June 28, 2019.

^kEzekowitz, J. A., O'Meara, E., McDonald, M. A., Abrams, H., Chan, M., Ducharme, A., et al. (2017). 2017 comprehensive update of the Canadian Cardiovascular Society guidelines for the management of heart failure. *Canadian Journal of Cardiology*, 33, 1342–1433. Retrieved April 14, 2020, from [onlinecjc.ca/article/S0828-282X\(17\)30973-X/fulltext](http://onlinecjc.ca/article/S0828-282X(17)30973-X/fulltext).

^lGilroy, S. A. (2020, March 5). HIV infection and AIDS. Retrieved April 15, 2020, from emedicine.medscape.com/article/211316-overview.

^mEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Blood Gas & Oximetry. Last updated June 28, 2019.

ⁿEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: TDM. Last updated June 28, 2019.

^oPublic Health Ontario. (2018, May 7). Hepatitis B surface antibody serologic testing updated – Changes to screening test. Retrieved April 14, 2020, from publichealthontario.ca/-/media/documents/lab/lab-sd-129-hepb-surface-ab-update.pdf?la=en.

^pIverson, C. (Chair). (2007). *AMA manual of style: A guide for authors and editors* (11th ed.). Chicago: American Medical Association.

^qEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Ortho Vitros. Last updated June 28, 2019.

Lipids^a

Clinical laboratory test	Normal value
Cholesterol, total, blood	3.5–5.2 mmol/L
Cholesterol, high-density lipoprotein (HDL), blood	
Female	> 1.3 mmol/L
Male	> 1.0 mmol/L
Cholesterol, low-density lipoprotein (LDL), blood ^b	See table below
Non-high-density lipoprotein (non-HDL), blood	≤ 4.5 mmol/L
Triglycerides, blood	≤ 1.7 mmol/L

^aEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Siemens Vista. Last updated June 28, 2019.

^bInterpretation of normal values for LDL varies depending on risk factors. Authors can decide if they want to include the LDL analysis table (see below).

Low-Density Lipoprotein (LDL) Analysis^a

Cardiovascular disease risk

When to consider initiating

Treatment target

treatment

High and intermediate	LDL level of ≥ 3.5 mmol/L	LDL level of < 2.0 mmol/L or $\geq 50\%$ reduction in pretherapy LDL level
Low	LDL level of ≥ 5.0 mmol/L	$\geq 50\%$ reduction in pretherapy LDL level

^aAdapted from the Ottawa Hospital Laboratory Services 2020.

Urine^a

Urinalysis (not dipstick)^b

Clinical laboratory test	Normal value
Specific gravity, urine	1.005–1.030
pH, urine	5.0–8.5
Urobilinogen, urine	≤ 16.0 $\mu\text{mol/L}$
Albumin to creatinine ratio, urine ^c	≤ 2.0 g/mol Cr
Osmolality, urine ^d	38– 1400 mOsm/kg H ₂ O

^aAll items refer to a random specimen unless specified otherwise (e.g., 24-h specimen).

^bEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Urinalysis. Last updated June 28, 2019.

^cEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Vista Urine Biochemistry. Last updated June 28, 2019.

^dDeWitt, D. (2018, September). Normal laboratory values: Urine. In Merck manual professional edition. Retrieved

Padillo, O. (2018, September). Normal laboratory values: Urine. In Merck manual professional edition. Retrieved April 14, 2020, from [merckmanuals.com/en-ca/professional/resources/normal-laboratory-values/urine-tests-normal-values#v8511272](https://www.merckmanuals.com/en-ca/professional/resources/normal-laboratory-values/urine-tests-normal-values#v8511272).

24-H Specimen

Clinical laboratory test	Normal value
Urine calcium (Ca), unrestricted diet, 24-h specimen ^c	2.5–7.5 mmol/24 h
Urine chloride (Cl), 24-h specimen ^c	110.0–250.0 mmol/24 h
Urine creatinine, weight-based, 24-h specimen ^c	
Female	5.3–15.9 mmol/24 h
Male	7.1–17.7 mmol/24 h
Urine metanephrine, 24-h specimen ^e	
Female	0.2–1.3 µmol/24 h
Male	0.3–2.0 µmol/24 h
Urine protein, 24-h specimen	< 0.2 g/24 h
Urine potassium (K), 24-h specimen ^c	25.0–125.0 mmol/24 h
Urinary free cortisol, 24-h specimen ^c	58.0–306.0 µg/24 h
Urine sodium (Na), 24-h specimen ^c	40.0–220.0 mmol/24 h

^cEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Vista Urine Biochemistry. Last updated June 28, 2019.

^eEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: HPLC. Last updated June 28, 2019.

Reproductive hormones

Clinical laboratory test	Normal value
Dehydroepiandrosterone sulfate (DHEA-S), blood ^a	
Female	
18–20 y	1.4–8.7 µmol/L
21–29 y	0.5–10.6 µmol/L
30–39 y	0.6–7.2 µmol/L
40–49 y	0.5–6.3 µmol/L
50–59 y	0.2–5.1 µmol/L
60–69 y	0.3–3.6 µmol/L
70–118 y	0.2–4.8 µmol/L
Male	
18–20 y	0.7–14.6 µmol/L
21–29 y	2.3–18.7 µmol/L

30–39 y	2.9–12.6 $\mu\text{mol/L}$
40–49 y	1.9–13.4 $\mu\text{mol/L}$
50–59 y	1.0–8.5 $\mu\text{mol/L}$
60–69 y	0.7–6.6 $\mu\text{mol/L}$
70–118 y	0.1–6.9 $\mu\text{mol/L}$
Estrogens, total, blood ^b	60–400 ng/L
Estradiol (E_2) [report the phase of the menstrual cycle], blood ^{c,d}	
Female	
Follicular phase	50–100 pmol/L
Midcycle peak	50–200 pmol/L
Luteal phase	70–150 pmol/L
Male	37–110 pmol/L
Follicle-stimulating hormone (FSH) [report the phase of the menstrual cycle], blood ^{a,d}	
Female	
Midfollicular phase	3.9–8.8 IU/L
Midcycle peak	4.5–22.5 IU/L
Midluteal phase	1.8–5.1 IU/L

Postmenopausal	16.7–113.6 IU/L
Male	1.0–19.0 IU/L
Human chorionic gonadotropin (β -hCG), nonpregnant, blood ^a	< 5 IU/L
Luteinizing hormone (LH) [report the phase of the menstrual cycle], blood ^{a,d}	
Female	
Midfollicular phase	2.1–10.8 IU/L
Midcycle peak	19.2–103.0 IU/L
Midluteal phase	1.2–12.9 IU/L
Postmenopausal	10.9–58.6 IU/L
Male	1.0–9.0 IU/L
Progesterone [report the phase of the menstrual cycle], blood ^{a,d}	
Female	
Midfollicular phase	1.0–4.8 nmol/L
Midluteal phase	16.4–59.0 nmol/L
Male	0.5–6.6 nmol/L
Prolactin, blood ^a	
Female	

Premenopausal	3–27 µg/L
Postmenopausal	3–20 µg/L
Male	3–13 µg/L
Testosterone, blood ^a	
Female	≤ 2.6 nmol/L
Male	6.1–27.1 nmol/L

^aEastern Ontario Regional Laboratory Association. EORLA regional biochemistry recommended reference intervals by instrumentation/analyzer: Beckman DXI. Last updated June 28, 2019.

^bIverson, C. (Chair). (2007). *AMA manual of style: A guide for authors and editors* (11th ed.). Chicago: American Medical Association.

^cPadillo, O. (2018, September). Normal laboratory values: Blood, plasma, serum. In *Merck manual professional edition*. Retrieved April 14, 2020, from [merckmanuals.com/en-ca/professional/resources/normal-laboratory-values/blood-tests-normal-values#v8508814](https://www.merckmanuals.com/en-ca/professional/resources/normal-laboratory-values/blood-tests-normal-values#v8508814)

^dFor phase of the menstrual cycle, generally, follicular phase is 0–10 days, midcycle peak is day 11–20, and luteal phase is day 21–30.

Semen analysis^a

Clinical laboratory test	Normal value
Ejaculate volume, semen	≥ 1.5 mL
pH, semen	≥ 7.2
Sperm concentration, semen	≥ 15 × 10 ⁶ spermatozoa/mL
Total sperm number, semen	≥ 39 × 10 ⁶ spermatozoa/ejaculate

Motility, semen	≥ 40%
Forward progression, semen	≥ 32%
Normal morphology, semen	≥ 4% normal
Sperm agglutination, semen	Absent
Viscosity, semen	≤ 2-cm thread after liquefaction

^aPractice Committee of the American Society for Reproductive Medicine. (2015). Diagnostic evaluation of the infertile male: a committee opinion. *Fertility and Sterility*, 103, e18–e125. Retrieved April 14, 2020, from [https://www.fertstert.org/article/S0015-0282\(14\)02528-X/fulltext](https://www.fertstert.org/article/S0015-0282(14)02528-X/fulltext)

Stool^a

Clinical laboratory test	Normal value
Fecal fat	< 5 g/day in patients on a 100-g fat diet

^aPadillo, O. (2018, September). Normal laboratory values: Stool. In *Merck manual professional edition*. Retrieved April 14, 2020, from [merckmanuals.com/en-ca/professional/resources/normal-laboratory-values/stool-tests-normal-values](https://www.merckmanuals.com/en-ca/professional/resources/normal-laboratory-values/stool-tests-normal-values)

Tests and analyses that do not require a normal value

Clinical laboratory test

Urine (not dipstick)

Eosinophils, urine
Sodium (Na), urine
Glucose, urine
Bilirubin, urine
Ketone, urine
Blood, urine
Protein, urine
Nitrite, urine
Leukocytes, urine

Urinalysis, dipstick testing

Bilirubin, urine
Blood, urine
Glucose, urine
Ketones, urine
Leukocyte esterase, urine
Nitrite, urine
Protein, urine

Chemical Constituents

Ethanol (ethyl alcohol)
Hepatitis A IgM antibody
Hepatitis A IgG antibody
Hepatitis C antibody
HIV viral load

Stool

Stool culture

Analyses

Pleural fluid
Cerebrospinal fluid
Synovial fluid
Ascitic fluid
