

Clinical Chemistry Reference Ranges

Test	Age	Reference Range
Acid base (blood gas)		
Hydrogen (H+) (nmol/L)	Newborn	32-47
	Neonate/Infant	35-48
	Child/Adult	35-45
pH	Newborn	7.33-7.49
	Neonate/Infant	7.32-7.45
	Child/Adult	7.35-7.45
pCO ₂ (kPa)	Neonate	3-6-5.4
	Infant	3.5-5.5
	Child	4.4-6.1
pO ₂ (Kpa)	Neonate	6.7-12.0
	Child	11.0-13.5
	Adult	10.5-13.5
	Imprecision	1.7
Calculated actual bicarbonate (mmol/L)	Child	17-27
	Adult	24-27
Calculated base excess (mmol/L)	Newborn	-10 to -2
	Infant	-7 to -1
	Child	-4 to +2
	Adult	-2 to +3
Acid Glycoprotein (orosomucoid) (g/L)	Child (>5y)/Adult	0.4-1.0 female 0.6-1.2 male
ACTH , 9am (ng/L)	Child/Adult	<46
Acute phase reactants		
Alpha-1-antitrypsin (g/L)	Neonate	0.9-2.2
	Infant	0.8-2.0
	Child	1.1-2.3
	Adult	1.1-2.1
Alpha-1-antichymotrypsin (g/L)	Adult	0.3-0.6
Alanine aminotransferase (ALT, SGPT) (U/L)	Male	<50 U/L
	Female	<35 U/L
Albumin (g/L)	Neonate	24-40
	Infant	25-49
	Child	35-48
	Adult	35-50
Alkaline Phosphatase (U/L)	Neonate	73-391
	Infant	59-425
	1y-14y	76-308
	14y-16y	49-242
	Adult	30-130
Alpha fetoprotein (kU/L)	Newborn	50,000-150,000
	2 weeks	7,000-20,000
	4 weeks	1,500-2,500
	6 weeks	200-400
	8 weeks	50-100

	10 weeks 3 month - Adult	6-12 3-8
Ammonia (µmol/L)	Neonate Infant/Child/Adult	<100 (if pre-term neonate - <150) <40
Amylase Plasma U/L Urine amylase/creatinine ratio u/mmol creatinine	Child/Adult Child/Adult	30-100 <38
Angiotensin Converting Enzyme (ACE) (U/L)	6m-19y	29-112
Androstenedione (nmol/l)	1-7 days 1-4 Weeks 1-12 months 1-10 years 10-17 years Male 17 yrs + Female 17 yrs + Follicular Luteal Post-menopausal Synacthen test 0mins 30 mins	≤ 10.8 nmol/L ≤ 9.2 nmol/L ≤ 3.1 nmol/L ≤ 2.3 nmol/L ≤ 6.9 nmol/L ≤ 7.8 nmol/L ≤ 7.8 nmol/L ≤ 6.0 nmol/L ≤ 10.3 nmol/L ≤ 6.5 nmol/L ≤ 7.6 nmol/L ≤ 11.7 nmol/L
Aspartate aminotransferase (AST, SGOT) (U/L)	Neonate Infant/Child Adult	18-92 13-61 5-61
Bicarbonate (total carbon dioxide) (mmol/L)	Neonate Infant Child Adult	14-30 16-30 19-28 22-29
Bile Salts Glycodihydroxycholanoate Plasma (µmol/L) Urine (µmol/mmol creatinine)		0-6 0.02-0.47
Bile Salts Glycodihydroxycholanoate Plasma (µmol/L) Urine (µmol/mmol creatinine)		0-2 0.04-1.39
Bile Salts Taurodihydroxycholanoate Plasma (µmol/L) Urine (µmol/mmol creatinine)		0-2 0.01-0.08
Bile Salts Taurodihydroxycholanoate Plasma (µmol/L) Urine (µmol/mmol creatinine)		0-2 0.01-0.08
Bilirubin, conjugated (µmol/L)	Neonate Child/Adult	Up to 10 Up to 2 (97.5 th centile)

Bilirubin , total paediatric (µmol/L)	Neonate (<28 days)	Variable dependent on child. Action limits for phototherapy/exchange transfusion vary from days of birth and are lower for premature babies – See nomogram in trust guidance.
	Infants >28d and children	<17
Biotinidase (U/L)	Child/Adult	2.5-10.5
C-peptide (fasting adults, pmol/L)	Adult	298-2350
C-Reactive Protein , CRP (mg/L)	All ages	<10 mg/L
Caffeine (mg/ml)		10-35mg/L
Calcium ionised (mmol/L)	Child/Adult	1.13 – 1.32 (adjusted to pH 7.4)
Calcium Total Plasma (mmol/L)	Neonate	2.14-2.74
	Infant	2.13-2.72
	Child	2.10-2.56
	Adult	2.14-2.51
Urine (mmol/24h)	Adult	2.5-7.5
Carbamazepine (Tegretol) (mg/L)	Child/Adult	4-12
Carnitine (µmol/L) Total Free		23-60
		15-53
Chloride (mmol/L)	Neonate	97-114
	Infant	98-113
	Child	98-111
	Adult	95-108
Cholestanol (µmol/L)	All	3-16
Cholesterol (mmol/L)	Neonate	1.5-4.0
	Infant	1.2-4.7
	Child	2.8-6.0
	16y-19y	2.8-5.7
	Adult (desirable)	<5.2
Cholinesterase (IU/L)		>5300
Complement Profile (g/L) C3 C4		0.75-1.65
		0.14 -0.54
Complement Components (g/L) C1 esterase inhibitor C3 nephritic factor		0.15-0.35
		Negative
Copper (µmol/L) Urine µmol/24h	0-6 months	5.9-16.3
	6 months to 1y	3.8-23.8
	Female 1y-13y	11.0-27.0
	Female 13y-49y	11.0-38.9
	Adult (male)	11.0-27.2
	Adult (female)	14.2-35
	Child/Adult	<0.9

Cortisol (nmol/L)		Early morning cortisol < 160 nmol/L suggests possible adrenal insufficiency and requires urgent discussion with the endocrine team and follow-up with a short synacthen test. Early morning cortisol > 340 nmol/L makes adrenal insufficiency highly unlikely. Early morning between 160-340 nmol/L, a short synacthen test may be required to exclude adrenal insufficiency. Suggest discuss with the endocrine team.
Please note the Synacthen test is only valid if the samples are taken promptly at 30 & 60 mins		
Creatinine kinase (creatine phosphokinase (CK, CPK) (U/L)	0-90d 90d-1y 1y-10y 11y-14y 15y-18y Adult	28-470 24-240 24-175 30-170 27-145 30-170
Creatinine (µmol/L)	Newborn Neonate Infant 1y-2y 2y-4y 5y-11y 12y-14y 15y+ Male 15y+ Female Child Neonate Child Adult	31-107 24-76 13-34 13-34 21-39 29-53 40-69 54-90 43-71 0.045-0.34 40-65 95-150 Over 100mL/min
Urine Creatinine mmol/kg body weight/24h Creatinine clearance (ml/min/1.73 sq.m)		
Cyclosporine (Ciclosporin) (µg/L)	Child/Adult	100-400 (trough levels)
7-Dehydrocholesterol (µmol/L) For the diagnosis of Smith Lemli Opitz Syndrome		>5
Normal (µmol/L)		<2
8-Dehydrocholesterol (µmol/L)		<3
DHEAS (µmol/L)	Male 1-7 days Male 8-15 days Male 1-6 months Male 6-12 months Male 1-4 y Male 4-7 y Male 7-11 y Male 11 y Male 12-15 y	2.5-10.2 1.0-6.1 <2.0 <0.7 <0.8 <0.5 <2.6 <4.1 <9.3

	Male 15-17 y	1.3-9.7
	Male 17 y	2.8-9.3
	Male 18-19 y	2.8-11.9
	Male 20-29 y	7.6-17.3
	Male 30-39 y	3.2-14.0
	Male 40-49 y	2.6-14.0
	Male 50-59 y	1.9-8.4
	Male 60-69 y	1.1-7.8
	Male >70 y	0.8-4.8
	Female 1-7 days	2.0-10
	Female 8-15 days	1.2-6.7
	Female 1-6 months	<2.0
	Female 6-12 months	<0.7
	Female 1-4 y	<2.1
	Female 4-7 y	<1.0
	Female 7-9 y	<1.8
	Female 9-11 y	<4.3
	Female 11 y	<2.7
	Female 12-14 y	0.8-4.8
	Female 14-17 y	0.9-9.6
	Female 17-20 y	2.6-10.9
	Female 20-29 y	1.8-10.3
	Female 30-39 y	1.2-7.3
	Female 40-49 y	0.9-6.5
	Female 50-59 y	0.7-5.4
	Female 60-69 y	0.4-4.0
	Female >70 y	0.4-2.4
Diazepam (with Nordiazepam) (µg/L)	Child/Adult	<2500
Digoxin (µg/L) Ideally 6-8h post dose	Child/Adult	Therapeutic target range 0.5-2.0 µg/L. In patients being treated for heart failure a target range of 0.5-1.0 µg/L is recommended (Hallworth and Watson "Therapeutic Drug Monitoring", ACB Venture Publications 2008 page 98).
Dimethylglycine (µmol/mmol creatinine)		0-16
Dopamine (nmol/mmol creat.)	0-1y	<1950
	1y-3y	<1450
	3y-5y	<950
	5y-8y	<850
	8y-11y	<750
	>12y	<650
Follicle stimulating hormone (FSH) (IU/L)	0-1 Month	<22.0
	Male 1 month -6y	<2.8
	Male 6y-11y	<3.8
	Male 11y-14y	<4.6
	Male 14y +	1.5-12
	Female 1 month – 14y	0-11
	Follicular phase	3.5-13

	Mid cycle Luteal phase Female 60y + (post menopausal)	4.7-22 1.7-7.7 26-135
Free T4 (pmol/L)	< 7 days 7 days - <2 months 2 month - < 9 years 9 years - <19 years	No reference range available 14.0 – 27.5 11.6 – 21.6 9.8 – 18.9
Free T₃ (pmol/L)	0 – 1 year 1 – 5 years 6 – 10 years 11 – 14 years 15 – 18 years	3.4 – 7.6 4.3 – 7.2 4.4 – 6.8 3.4 – 6.5 2.9 – 6.8
Galactose-1-Phosphate (μmol/GM-Hb) Galactosaemia on galactose free diet	Child/Adult	Up to 30 >0.6
Gamma-glutamyl transferase (U/L)	Newborn Neonate 1m-3m 4m-6m 7m-12m Child Adult	24-227 11-149 <123 <53 8-20 10-27 9-31
Glucose plasma (mmol/L) Urine (mmol/L) CSF (mmol/L) CSF/plasma glucose ratio (mmol/mmol)	All ages Neonate Child Diabetic in control Child	3.2 - 6.0 (upper limit only applies for fasted samples) Up to 1.1 Up to 0.3 Up to 150 mmol/24 h 2.8-4.4 >0.6
Glycated haemoglobin (HbA1c) (mmol/mol Hb)	Child/Adult	20.0-48.0
Glycosaminoglycans (mucopolysaccharides MPS) (Screen) Mg/mmol creatinine	0-1m 1m-3m 3m-6m 6m-12m 1y-2y 2y-3y 3y-5y 5y-7y 7y-9y 9y-11y 11y-13y 13y-15y over 15y	22.1-40.8 9.2-38.8 11.9-34.5 4.2-30.5 6.8-21.7 9.7-19.5 6.2-15.4 6.2-12.1 4.1-10.8 4.5-10.8 2.8-10.4 2.0-7.6 1.7-4.4
Growth hormone (μg/L)	0-7d 5-15d 15d-11y 11y-18y 18y+	1-23 1-15 <4.7 <11 <4.3

Haematinics B12 (ng/L)	0-11m	184 - 1000
	11m-11y	324 - 1000
	11y-18y	237 - 912
Folate (µg/l)	Normal	3.1 - 20.5
Ferritin (µg/l)	Female	
	0 to <2 Weeks	69-527
Ferritin (µg/l)	2 Weeks to <13 Years	10-76
	13 to <19 Years	8-70
	Male	
	0 to <2 Weeks	69-527
	2 Weeks to <13 Years	10-76
	13 to <19 Years	13-114
Hexanoylglycine (µmol/mmol creatinine)	Normal	0.1-1.1
High Density Lipoprotein (HDL) – Cholesterol (mmol/L)	Child	0.8-2.1
	Adult	1.0-1.7
Homocysteine Total (µmol/l)	Adult male	0-18
	Adult female	0-16
Homovanillic acid (HVA) (µmol/mmol creatinine)	Infant	4-25
	1y-5y	2-15
	>5	2-13
Human chorionic gonadotrophin (hCG) (IU/L)	Males, Non-pregnant women	<2
17-alpha-Hydroxyprogesterone (nmol/L) Range may be higher in ill and premature neonates	1-14d	≤ 9.2 nmol/L
	2-13w	≤ 8.7 nmol/L
	3m-1y	≤ 5.7 nmol/L
	1y-3y	≤ 2.9 nmol/L
	3y-11y	≤ 2.9 nmol/L
	11y-15y	≤ 4.5 nmol/L
	>15 years male	≤ 6.0 nmol/L
	Female	
	Follicular	≤ 4.4 nmol/L
	Luteal	≤ 14.3 nmol/L
	Post-menopausal	≤ 2.9 nmol/L
	Synacthen test	
	0 mins	≤ 6.2 nmol/L
	30mins	≤ 12.6 nmol/L
IGF-1 (µg/L)	0-2y	28-156
	2-4y	40-189
	4-6y	50-223
	6-7y	62-248
	7-8y	78-281
	Female 8-9y	99-376
	Female 9-10y	114-369
	Female 10-11y	134-426
	Female 11-12y	160-581

	Female 12-13y	201-707
	Female 13-14y	256-716
	Female 14-15y	284-713
	Female 15-16y	279-700
	Female 16-17y	270-660
	Female 17-18y	246-533
	Female 18-19y	233-499
	Male 8-9y	90-284
	Male 9-10y	102-304
	Male 10-11y	117-305
	Male 11-12y	129-339
	Male 12-13y	141-419
	Male 13-14y	179-540
	Male 14-15y	229-691
	Male 15-16y	269-697
	Male 16-17y	267-673
	Male 17-18y	243-527
	Male 18-19y	235-512
	19-20y	220-471
	20-30y	115-340
	30-40y	109-324
	40-50y	103-310
	50-60y	97-292
	60-70y	91-282
	70-80y	47-207
	>80y	40-184
Immunoglobulins		
IgG (g/L)	Neonate	3.9-17.0
	Infant	2.1-10.9
	Child	3.1-16.1
	Adult	6.0-16.0
IgA (g/L)	Neonate	0.01-0.15
	Infant	0.05-0.7
	Child	0.3-2.8
	Adult	0.8-4.0
IgM (g/L)	Neonate	0.05-0.4
	Infant	0.15-2.1
	Child	0.5-2.2
	Adult	0.5-2.0
IgE (kU/L)	Neonate	Up to 5
	Infant	Up to 11
	Child	Up to 63
	Adult	Up to 120
Insulin (from 24/1/11) (pmol/L)	Fasting adult	17.8-173
Iron (μmol/L)	0-2y	3.6-25.0 μmol/L
	>2y	3.6-26.0 μmol/L
Lactate fasting (mmol/L)	Neonate	Up to 3.0
	Child	0.9-1.8
	Adult	0.6-2.4
Lactate dehydrogenase (LDH) (U/L)	Neonate	120 - 246 U/L

	Child	120 - 246 U/L
Lipase (U/L)		<60
Lithium (mmol/L)		0.4 – 1.0 (risk of toxicity if >1.5)
Low Density Lipoprotein (LDL cholesterol) (mmol/L)	All ages	<3.5 mmol/L
Luteinising hormone (LH) (IU/L)	Male 0-1y Male 1y-11y Male 11y-14y Male 14y-17y Male 17y+ Female 0-6y Female 6y-11y Female 11-14y Follicular phase Mid cycle Luteal phase Female 60y + (post menopausal)	<3.2 <1.4 <7.8 1.3-9.8 1.7-8.6 <0.5 <3.1 <11.9 2.4-13 14-96 1.0-11 7.7-59
Magnesium Plasma (mmol/L)	Neonate Infant/Child Adult	0.6-1.04 0.64-1.09 0.7-1.0
Urine (mmol/kg body weight/24h) (mmol/24h)	Child Adult	Up to 0.18 2.4-6.5
Manganese (nmol/L)	<1y Child/Adult	120-325 73-210 >364
Risk of toxicity		
Methylmalonate (μmol/mmol creatinine)	Child Adult	1.0-8.0 0.2-2.4
Microalbumin (mg/mmol creatinine)		<2
Myoglobin (μg/L)		
Serum		28-84
Urine		<10
Noradrenaline (nmol/24h)	0-1y 1y-3y 3y-5y 5y-8y 8y-11y >11y	<430 <200 <190 <180 <170 <130
17β-Oestradiol (pmol/L)		Dependant on referral laboratory used.
Orotic acid (μmol/mmol creatinine)	Infant/Child/Adult	<3.5
Osmolality Plasma (mmol/kg) Urine (mmol/kg) After water deprivation administration Maximum dilution Maximum concentration	Child/Adult Neonate/Child Adult Adult	275-295 100-800 over 800 40-100 600-1400
Oxalate (mmol/24h)	Child Adult Female Adult Male	0.14-0.42 0.04-0.34 0.08-0.49

Paracetamol (mg/L) Therapeutic range 1-2 h after last dose Overdose; sample taken not less than 4h after overdose: 4 hour levels Refer to Nomogram in BNF	Child/Adult	Up to 30 >100 (treatment indicated – See BNF)
Parathyroid hormone (PTH) (ng/L)	2y 9y 17y 19y	6.4 - 88.6 16.2 - 63.0 21.9 - 87.6 16.0 - 60.4
pH Urine Within 3 hrs of an ammonium chloride load	Neonate Child	Over 5.0 5.3-7.2 <5.3
Phenobarbitone (Phenobarbital) (mg/L) Trough level after at least 14d of constant therapy	Child/Adult	10-40
Phenylalanine fasting (μmol/L)	Newborn <6m 6m-2y 2y-10y 10y-17y Adult	40-110 32-128 40-140 20-130 30-115 40-100
Phenytoin (mg/L) See Trust guidelines for Therapeutic Drug Monitoring (1523)	Child/Adult	5-20
Phosphate fasting (mmol/L) Plasma	Neonate Infant Child Adult	1.0-2.7 1.1-2.4 0.8-1.9 0.8-1.5
Urine (mmol/kg/body weight/24h) (mmol/24h)	Child Adult	0.33-1.28 15-50
Phosphoethanolamine (μmol/mmol Cr) Heterozygote 3-8 x normal Homozygote 10-50 x normal	Child/Adult	<10
Phytanate (μmol/L)	Normal	0.2-19.3
Plasmalogens in red blood cells(ratio) C16 Palmitate C18 Stearate		0.060-0.160 0.150-0.400
Potassium Plasma (mmol/L)	Neonate Infant Child Adult	3.5-6.5 3.5-5.7 3.5-5.4 3.5-5.3
Urine (mmol/kg body weight)	Neonate Child Adult	Up to 2.3 Up to 2.0 (25-125 mmol/L) 25-100 mmol/24h
Pristanic acid (μmol/L)	Normal	0-1.88
Progesterone (nmol/L)	Male Female 14-60y	0.7-4.3 No range
Prolactin (mU/L)	0-1y Male 1y +	No range 86-324

	Female 1y +	102-496
Protein total		
Plasma (g/L)	Neonate	33-72
	Infant	48-78
	Child	60-83
	>17yr	60-80
Urine (mg/24h)	Neonate	Up to 10
	Child	Up to 50
	Adult	Up to 100
Urine protein/creatinine ratio (mg/mmol creatinine)		<20
CSF (g/L)	Newborn	0.3-1.4
	Neonate	0.3-1.2
	1m-2m	0.2-0.9
	2m-6m	0.1-0.7
	>6m	0.1-0.4
Salicylate (mg/L)		
Therapeutic range	Child	Therapeutic level <200
Overdose 4h after ingestion		Refer to toxbase for guidelines on toxicity
Selenium (μmol/L)	<2y	0.22-1.22
	2y-4y	0.33-1.44
	4y-16y	0.52-1.52
	>16y	0.61-1.24 μg-Hb
Glutathione peroxidase (μg-Hb)		
Sex hormone binding globulin (SHBG) (nmol/L)	Child	No paediatric ranges available
	Adult Female 20-50y	32.4 - 128
	Adult Male 20-50y	18.3 - 54.1
Sodium		
Plasma mmol/L)	Neonate	131-143
	Infant	133-142
	Child	133-144
	Adult	133-146
Urine (mmol/kg body weight/24h)	Neonate	Up to 4.4
	Child	Up to 3.7(40-200 mmol/24h)
	Adult	100-200 mmol/24h
s-Sulphocysteine (μmol/mmol creatinine)		<10
Testosterone (nmol/L)	Male 0-1 month	2.6-14
	Male 1m-6m	<6.1
	Male 6m-6y	<1.12
	Male 6-13y	<2.37
	Male 13-18y	0.98-38.5
	Male 18y +	8.6-29.0
	Female 0-1 month	0.7-2.2
	Female 1m-10y	<0.4
	Female 10-12y	<0.9
	Female 12y +	0.30-1.7
Theophylline (mg/L)	>1 month/Adult	44105
		Can be lower in neonates
Thyroid stimulating hormone (TSH, thyrotrophin) (mU/L)	< 7 days	No reference range reported
	7 days - < 1 month	1.07 – 8.20
	1 month - < 13 years	0.76 – 5.91

	13 years - <19 years	0.50 – 4.88
Transferrin (g/L)	Child/Adult	2.0-3.2
Triglyceride fasting (mmol/L)	Neonate Infant Child Adult	<1.8 0.3-1.7 0.4-2.1 <2.5
Trimethylamine (and Oxide) (μmol/mmol cr.)		Interpretation given on report
Urea (mmol/L)	Neonate Infant Child Adult	0.5-5.7 0.3-4.7 1.6-6.0 2.5-7.8
Uric acid Plasma (μmol/L)	Neonate Child <10y Child >10y Adult (male) Adult (female)	120-470 160-390 160-500 200-430 140-360
Urine (mmol/mmol creatinine)	Neonate Infant Child Adult	0.3-1.7 0.3-1.3 0.3-0.8 0.3-0.5 (1.5-4.5 mmol/24h)
Valproate (mg/L)	Child/Adult	50-100 >150 may be toxic
Very long chain fatty acids (peroxisomal disorders) C22 (μmol/L) C24 (μmol/L) C26 (μmol/L) C24/C22 C26/C22		15-112 14-80 0.33-1.50 0.44-0.97 0.005-0.030
Vitamins A (μmol/L) C (ascorbic acid μmol/L) D (nmol/L) E (μmol/L) Vitamin E/Lipid ratio (μmol/L)	Neonate/Infant 1-6y 7y-11y 12y-18y >19y Neonate Child <16y >16y-adult 1y-6y 7y-12y 13y-19y Adults	0.50-1.50 0.70-1.50 0.91-1.71 0.91-2.51 0.84-3.60 26.1 – 84.6 <25 Vitamin D deficiency. Consider treatment. 25-50 Suboptimal vitamin D status. Advise on dietary and lifestyle change to improve vitamin D status. Consider vitamin D supplementation. Ensure dietary calcium intake is adequate. >50 Vitamin D adequate in context of normal health and adequate dietary calcium intake. 4.6-14.0 9.0-28.0 11.6-35.5 3-5 2-5 2-4 >1.6
Vanillyl mandelic acid (VMA) (μmol/mmol creatinine)	Infant 1y-5y	2-12 2-9

	>5y	1-7	
Zinc (µmol/L)	Infant/Child/Adult	7.2-20.4	