

FACTSHEET – BLOOD TEST RESULTS

Test	Normal Value	Clinical significance of variations
<i>Haematology</i>		
Haemoglobin (Hb)	13-18g/dl (men) 11.5-16g/dl (women)	Increases – polycythaemia, high altitude, chronic pulmonary disease Decreases – anaemia, haemorrhage
White cell count (WCC)	4-11 ($\times 10^9/l$)	Increases – acute infection, leukaemia Decreases – aplastic anaemia, radiation sickness <ul style="list-style-type: none"> • Neutrophils Increased - bacterial infections, trauma, surgery, burns, haemorrhage, inflammation, infarction, severe childhood infection, polymyalgia, leukaemia, disseminated malignancy Decreased – viral infections, brucellosis, typhoid, TB, septicaemia • Lymphocytes Increased – viral infections, toxoplasmosis, whooping cough, brucellosis, chronic lymphatic leukaemia (CLL) Decreased – systemic lupus erythematosus (SLE), AIDS, post chemotherapy/radiotherapy, steroid therapy • Eosinophils Increased – asthma, allergic disorders, parasitic infections, eczema, malignant diseases • Monocytes Increased – acute and chronic infection, malignant disease • Basophils Increased – viral infections, urticaria, myxoedema, chronic myeloid leukaemia (CML)
Platelets	150-400 ($\times 10^9/l$)	Increases – thrombocytopenia, rheumatoid disease, bleeding, post splenectomy (approx 50% of unexplained thrombocytopenia have malignancy) Decreases – marrow failure, megablastosis, immune thrombocytopenia purpura, viruses, disseminated intravascular coagulation (DIC), drugs, systemic lupus erythematosus (SLE), lymphoma, hypersplenism

Mean cell volume (MCV)	76-96fl	Increases – B12 or folate deficiency, alcohol, liver disease, reticulocytosis, myelodysplastic syndromes, marrow infiltration, hypothyroidism, antifolate drugs (eg phenytoin) Decreases – iron deficient anaemia, thalassaemia, congenital sideroblastic anaemia
International normalized ratio (INR)	0.9-1.2	Prothrombin time expressed as a ratio to a control. Suggested INR: <ul style="list-style-type: none"> • 2.0-3.0 for treating DVT, PE • 2.5-3.5 for embolism prophylaxis in AF • 3.0-4.5 for recurrent DVT and PE, arterial grafts, prosthetic valves Prolonged by coumarins (eg warfarin), vitamin K deficiency, liver disease
Thrombin time	10-15 secs	Raised in heparin treatment, DIC
Kaolin cephalin clotting time/partial thromboplastin time (KCCT/APPT=PTT)	35-45 sec	Prolonged in heparin treatment, haemophilia
Haemocrit	0.4-0.54 l/l (men) 0.37-0.47 l/l (women)	Increases - dehydration
Erythrocyte sedimentation rate (ESR)	Generally upper limit: age/2 (men) (age+10)/2 (women)	Increases - with age, malignancies, connective tissue disorders, rheumatoid arthritis, renal disease, infection. A marked rise >100mm/h Decreases - polycythaemia, sickle-cell anaemia

Blood gases		
pH	7.35-7.45	if <7.35 client is acidotic, if >7.45 there is alkalosis
PaO ₂	>10.6 75-100 mmHg	See below **
PaCO ₂	4.7-6 35-54mmHg	See below **
Bicarbonate (HCO ₃)	22-28 mmol/l	See below **
Base excess	+/- 2 mmol/l	measure of metabolic acidosis/alkalosis.
** If client is acidotic and PaCO ₂ is raised client has a respiratory problem. If client is acidotic but PaCO ₂ stays the same or falls then the change is compensatory. If client is acidotic and HCO ₃ is low then client has metabolic acidosis. Metabolic acidosis can occur when in shock, where there is severe infection, lack of oxygen, and diabetes (there are other causes).		

Biochemistry		
Sodium (Na)	135-145 mmols/l	Increases – water loss > sodium loss, diabetes insipidus, incorrect IV fluid replacement Decreases – diuretics, water excess, dehydration, renal failure, diarrhoea, cardiac failure, cirrhosis of the liver
Potassium (K)	3.5-5 mmols/l	Increases – oliguric renal failure, potassium sparing diuretics, metabolic acidosis, potassium therapy, Addison's disease. Signs and symptoms – cardiac arrhythmias, sudden death. ECG changes Decreases – diuretics, vomiting and diarrhoea, pyloric stenosis, intestinal fistulae, Cushing's syndrome, Conn's syndrome. Signs and symptoms – muscle weakness, hypotonia, cardiac arrhythmias, cramps.
Creatinine (Cr)	75-150 µmols/l	Increases – chronic renal failure, acute renal failure
Urea (U)	2.5-6.7 mmols/l	Increases - acute renal failure, chronic renal failure, cytotoxics, thiazides, lymphoma, leukaemia, psoriasis, haemolysis muscle necrosis, primary gout, hyperparathyroidism, hypertension, dehydration
Calcium	2.12-2.65 mmols/l	Increased–malignancy,hyperparathyroidism, dehydration Decreased – thyroid surgery, chronic renal failure, hypoparathyroidism
Glucose (Gl) – fasting	3.5-5.5 mmols/l	Increases – diabetes mellitus >7.8 mmols (hyperglycaemia) Decreases – diabetes (hypoglycaemia), insulin, pituitary insufficiency, liver failure, Addison's disease, insulinoma
Albumin	35-50g/l	Increases – dehydration or can be an artefact Decreases -liver disease, nephrotic syndrome, burns, malabsorption, malnutrition, artifact (results in oedema)
Phosphate	0.8-1.45mmol/l	
Chloride	95-105 mmol/l	
C reactive protein (CRP)	<0.8mg/l	Increased - inflammatory conditions, increases in hours and falls within 2-3 days of recovery. Raised by active rheumatic disease, tissue injury or necrosis, burns, etc Highest levels seen in bacterial infections.
Magnesium	0.75-1.05 mmol/l	Increased – renal failure Decreased – diarrhoea, ketoacidosis, alcohol, TPN
Zinc		Decreased – total parenteral nutrition (TPN), inadequate diet, rarely - genetic

Hormones		
Luteinizing hormone (LH)	3-13u/l (premenopausal) 3-12u/l (follicular) 20-80u/l (ovulatory peak) 3-16u/l (luteal) >30u/l(post menopausal)	
Follicle stimulating hormone (FSH)	2-8u/l (luteal) 8-15u/l (ovulatory peak) 0.5-5u/l (follicular phase and men) >30u/l(post menopausal)	<p>Increased - Klinefelter syndrome, Turner syndrome and other chromosomal abnormalities, cryptorchidism, mumps, radiation, some chemotherapy agents, torsion of the testes</p> <p>Decreased - Kallmann syndrome, idiopathic hypogonadotropic hypogonadism associated with mental retardation, craniopharyngiomas pituitary adenomas, hypothalamic/pituitary surgery or radiation, pituitary apoplexy, head trauma - fracture the skull base which severs the hypothalamic-pituitary stalk, glucocorticoid excess, sex steroid-secreting tumours, prolonged administration of high doses of anabolic steroids, anorexia nervosa, congenital adrenal hyperplasia</p>
Growth hormone	<20mu/l	
Thyroid Stimulating hormone (TSH)	<5.7mu/l	<p>Increased – thyroid failure (hypothyroidism aka myxoedema)</p> <p>Increased TSH with normal T4 indicates partial thyroid failure caused by hyperthyroidism treatment, autoimmune disease, iodine deficiency</p> <p>If TSH not raised but T3 and T4 are raised then secondary hypothyroidism, pituitary failure.</p> <p>Decreased – hyperthyroidism (thyrotoxicosis)</p>
T4	70-140 mmols/l	<p>Increased – hyperthyroidism (NB pregnancy and oestrogens can give a false high)</p> <p>Decreased – hypothyroidism (NB salicylates, phenytoin, steroids, etc can give false lows)</p>
Adrenocorticotrophic hormone	<80ng/l	Increased – Cushing's disease, Addison's disease

Liver function tests		
Bilirubin	3-17 μ mol/l 0.25-1.5mg/100/ml	Increased – cholestasis, hepatocellular disease, viruses (hepatitis), cirrhosis, sepsis, gallstones, carcinoma head of pancreas, benign stricture of the common bile duct, paracetamol excess
Alanine-amino transferase (ALT)	3-35 iu/l	Increased – liver disease, shock
Aspartate-amino transferase (AST)	3-35 iu/l	Increased – liver disease, post myocardial infarction, skeletal muscle damage
Alkaline phosphatase	30-300 iu/l	Increased – liver disease, bone disease, growing children, healing fractures, renal failure

Cardiac/lipids		
Creatinine kinase (CK)	25-195iu/l (men) 25-170 iu/l (women)	Increased – myocardial infarction, muscle damage, drugs (eg statins)
Lactate dehydrogenase (LDH)	1.55-4.4mmol/l	Increased – following myocardial infarction, liver disease, pulmonary embolism
High density lipoprotein (HDL)	0.9-1.93mmol/l	A 'good' cholesterol. A high level of this is thought to protect against heart attacks.
Cholesterol	4-<6 mmols	Increased – risk of coronary heart disease
Triglycerides	0.5-1.9 mmols/l	Increased – heart disease, obesity, diabetes
Amylase	0-180	Increased – acute pancreatitis, uraemia, diabetic ketoacidosis

- 1 Please note that the above figures are a guide only – they have all been taken from medical sources but AvMA cannot guarantee their accuracy.
- 2 The conditions listed as a result of an increase/decrease are not exhaustive.
- 3 The above figures relate to adults, the values are likely to be different for children.
- 4 If there are any other tests you would like to have included on this factsheet please email ls@avma.org.uk