Specialised Biochemical Testing

Osteoporosis Diagnosis: Prevention of the Silent Disease

Osteoporosis is a disease of bones that leads to an increased risk of fracture. In osteoporosis, the bone mineral density (BMD) is reduced, the bone micro architecture is deteriorating, and the amount and variety of proteins in bone is altered. It is the leading bone disease in the world. It affects both men and women, and can even affect children. It is a disease in which the quality of the inside of the bone weakens, leading to an increased risk of fractures (broken bones).

Osteoporosis is called 'the silent disease' as it often goes undetected until it is too late, the patient has suffered multiple fractures, and may already have lost independence. Crucially however, the disease is preventable in the majority of people and can be treated.

Education, prevention, and an increased public awareness of the risk factors of osteoporosis are vital if we are to reverse the growing numbers of people developing the disease.

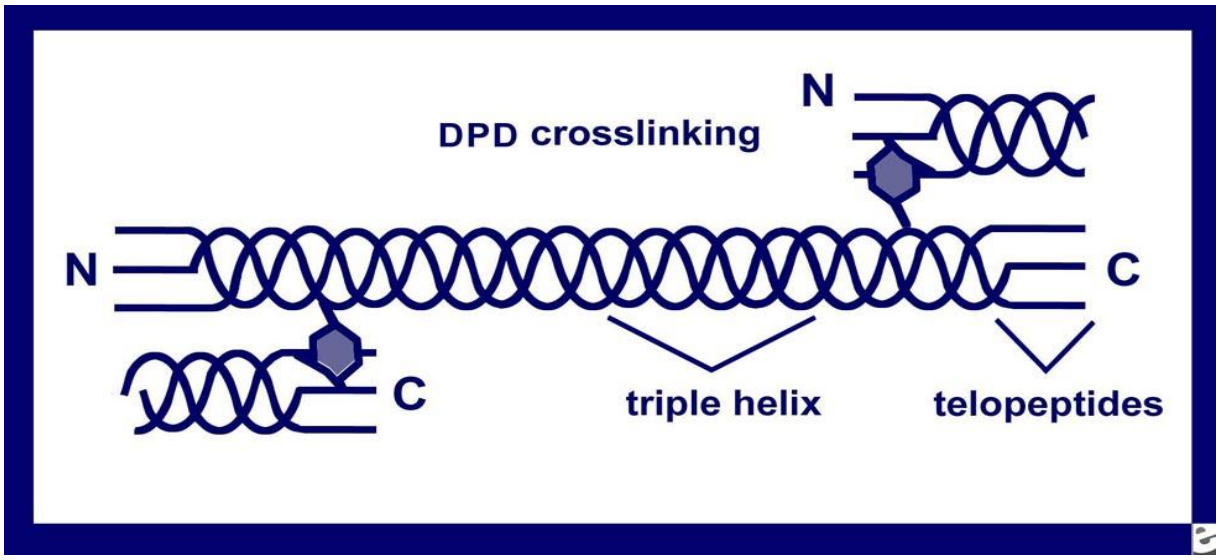
In Al-Jawhara Centre, the most recent and sophisticated tests are available for diagnosis, prevention, and treatment of osteoporosis.

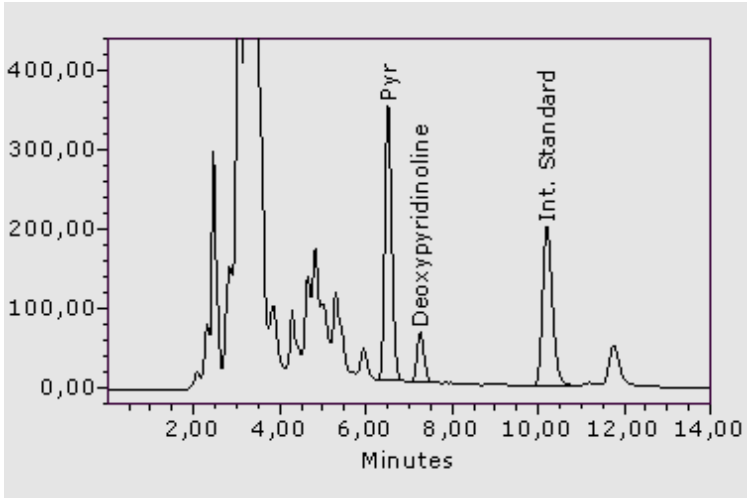
Crosslinks in Urine

The field of bone turnover markers has developed considerably in the past decade. Biochemical monitoring of bone metabolism depends upon measurement of enzymes and proteins released during bone formation and of degradation products produced during bone resorption. Various biochemical markers are now available that allow a specific and sensitive assessment of the rate of bone formation and bone resorption of the skeleton. Although these markers are not recommended for use in diagnosis of osteoporosis yet, they appear to be useful for the individual monitoring of osteoporotic patients treated with antiresorptive agents.

Such markers can also be useful in selected cases to improve the assessment of individual fracture risk when bone mineral density (BMD) measurement by itself does not provide a clear answer. The combined use of BMD measurement and bone markers is likely to improve the assessment of the risk of fractures in those cases.

Hydroxypyridinium cross-links of collagen, PYD, and DPD. The pyridinium compounds, PYD and DPD, are formed during the extracellular maturation of fibrillar collagens and are released upon the degradation of mature collagens. The measurement of PYD and DPD is not influenced by degradation of newly synthesised collagens and independent of dietary sources. While PYD is found in cartilage, bone, ligaments, and vessels, DPD is found in bone and dentin only. The PYD/DPD ratio in urine is similar to the ratio of these 2 cross-links in bone, which suggests that both cross-links are derived predominantly from the bone. PYD and DPD are present in urine as free moieties. The two urinary Crosslinks, Pyridinoline PYD, and Deoxypyridinoline DPD are tested with HPLC system.

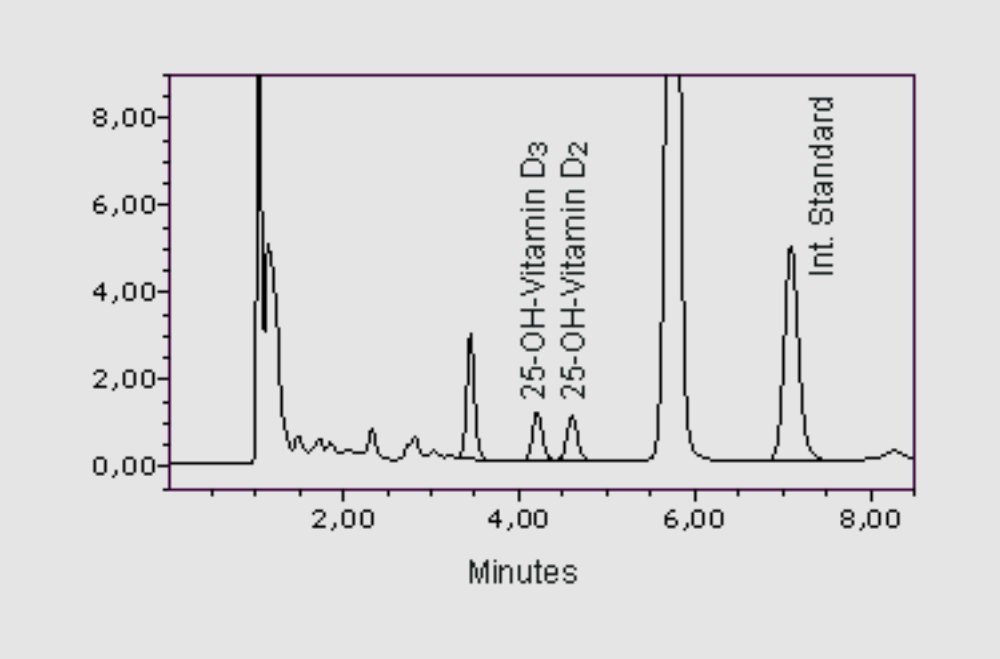




Accurate high performance liquid chromatography analysis of PYD and DPD in the urine is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

25-OH-Vitamin D_3/D_2 in Serum/Plasma

For the diagnosis of a bone mineralization and malfunction, 25-OH-Vitamin D_3 is a recognised clinical determinant. 25-OH-Vitamin D_2 is also measured for monitoring the therapy of vitamin D deficiency using vitamin D_2.



Accurate high performance liquid chromatography analysis of 25-OH vitamin D_3 and 25-OH vitamin D_2 the urine serum is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Genotyping of Polymorphism that is Associated with Bone Metabolism Related Disorders

The risk of developing low Bone Mass Density (BMD) depends on environmental, nutritional, and hormonal factors. In particular, the latter of these factors plays a crucial role in bone metabolism diseases. Recent studies have demonstrated that genetic factors have an influence on bone remodelling, contributing to get a variation of the bone mass up to 80%. Molecular diagnostic unit at Al-Jawhara Centre proposes the simultaneous detection of a battery of polymorphisms that have been involved in metabolic bone disorders. The genes detected are collagen type1, vitamin D receptor, oestrogen receptor, and calcitonin receptor. Mutations in these genes have been related to bone metabolic disorders. The information regarding these target genes can play an essential role in order to take clinical decisions and support certain therapies, thus contributing to provide patients with personalised treatments.

In addition, together with bone mineral density results, genotyping of these genes may provide essential information in the following clinical situations:

· Detection of patients with a family history of osteoporosis.

· Patients with multiple fractures at an early age.

· Hormonal problems.

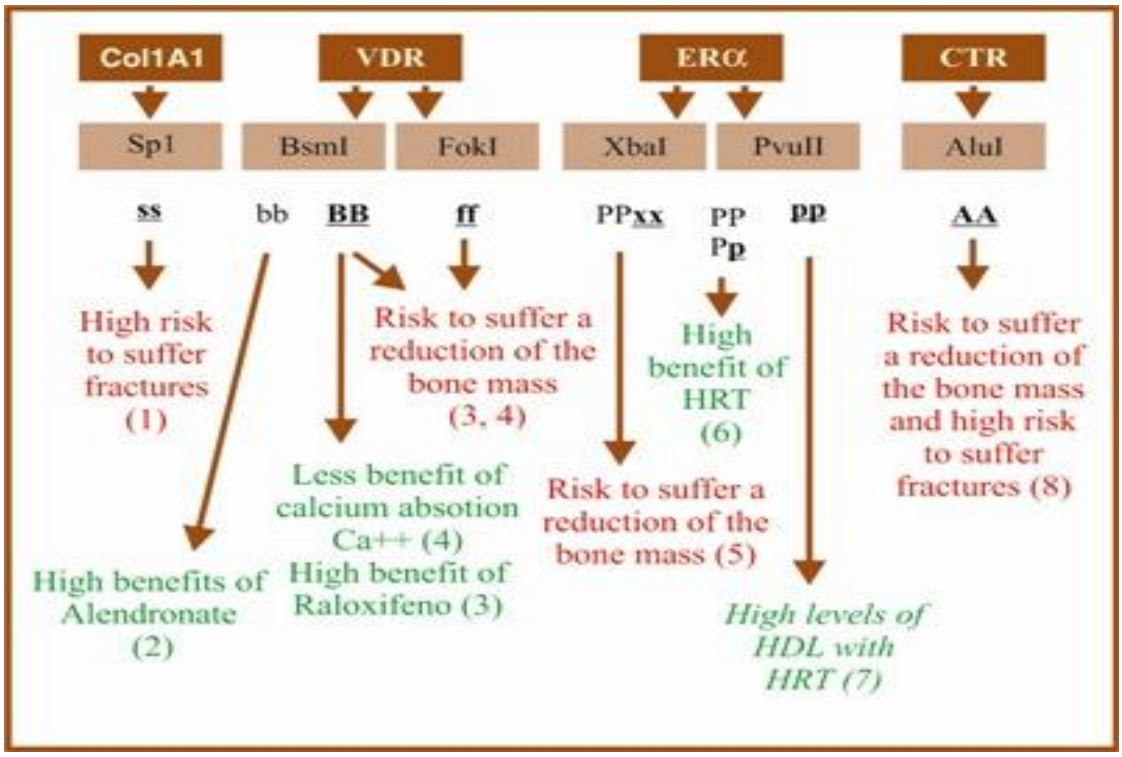
· Prolonged ingestion of steroids or anticonvulsives.

· Pre-transplant evaluation of bone metabolic diseases.

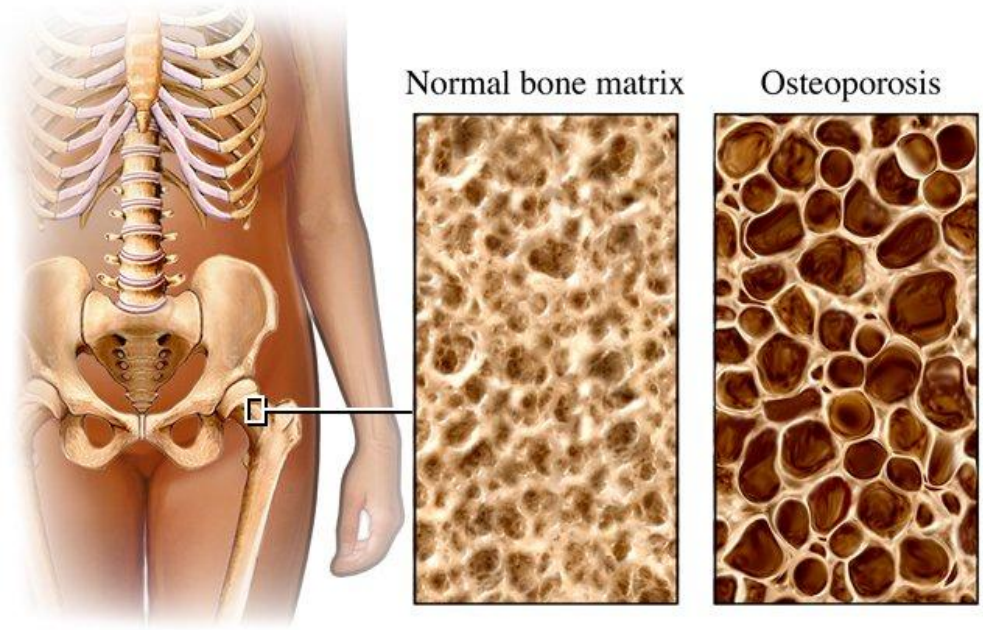
· Post-transplant bone prevention.

GENE	SNP	Normal variant (Homozygous)	Polymorphic variant (Homozygous)	Both variants (Heterozygous)
Collagen Type I	COL1A1-SPI	SS	ss	Ss
Vitamin D receptor	VDRF-FOKI	FF	ff	Ff
Vitamin D receptor	VDRB-BSMI	BB	bb	Bb
Calcitonin receptor	CTR-ALUI	AA	aa	Aa
Estrogen receptor	ESR1X-XBAI	XX	xx	Xx
Estrogen receptor	ESR1P-PVUII	PP	pp	Pp

SNP's and variant alleles of genes associated with metabolic bone disorders.



Relation between variant alleles and symptoms of osteoporosis. HRT (hormone replacement therapy), HDL (high density lipoprotein).



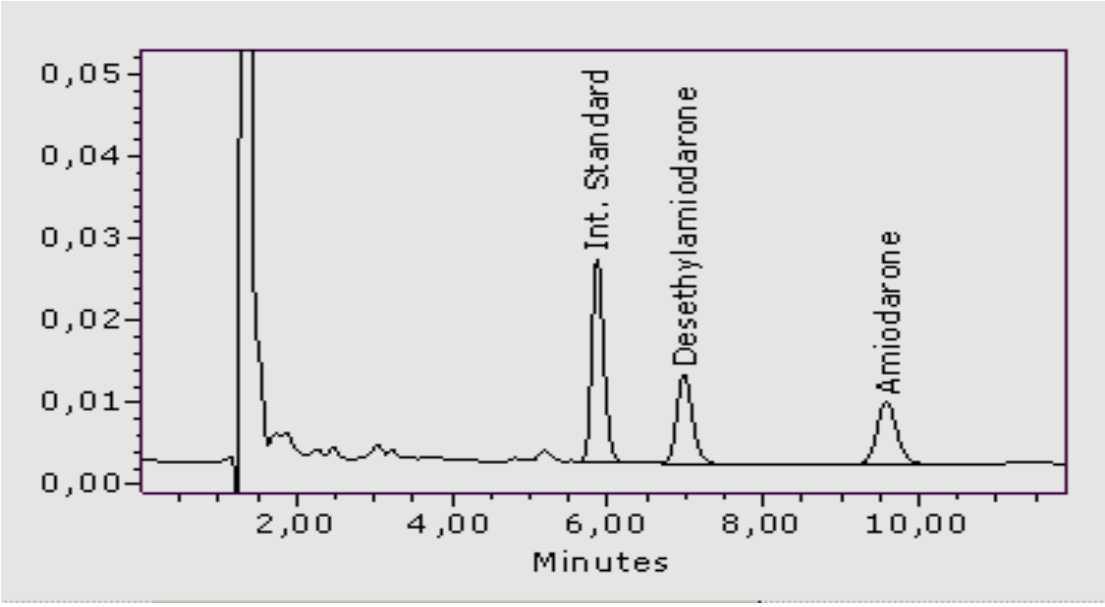
Therapeutic Drug Monitoring
Maximum Benefit from a Prescribed Drug

Many medications are used in medicine without monitoring of blood levels, as their dosage can generally vary according to the clinical response that a patient gets to that substance. In a small group of drugs, this is impossible, as insufficient levels will lead to under treatment or resistance, and excessive levels can lead to toxicity and tissue damage. Therapeutic drug monitoring (TDM) is the determination of specific drugs in biological samples at timed intervals in order to maintain a relatively constant concentration of the medication in the bloodstream. Drugs that are monitored normally have a narrow 'therapeutic index'. This is the effective concentration of a drug required that is close to the level that causes significant side effects and/or toxicity. Maintaining this steady state is not as simple as giving a standard dose of medication. This is because each individual can absorb, metabolize, utilize, and eliminate drugs at different rates depending on their general state of health, age, sex, genetic makeup, and the interaction of other medications that are taken at the same time. These rates may also change over time and may vary from day to day or from various disease states.

In the Specialised Biochemistry unit at Al-Jawhara Centre, the TDM service is proposed using the most sophisticated analytical techniques. The basic goal of therapeutic drug monitoring is to minimize the risks of toxicity, hence to enhance the patient's chance of maximum benefit from a prescribed drug.

Antiarrhythmics
Amiodarone & Desethylamiodarone in Serum/Plasma

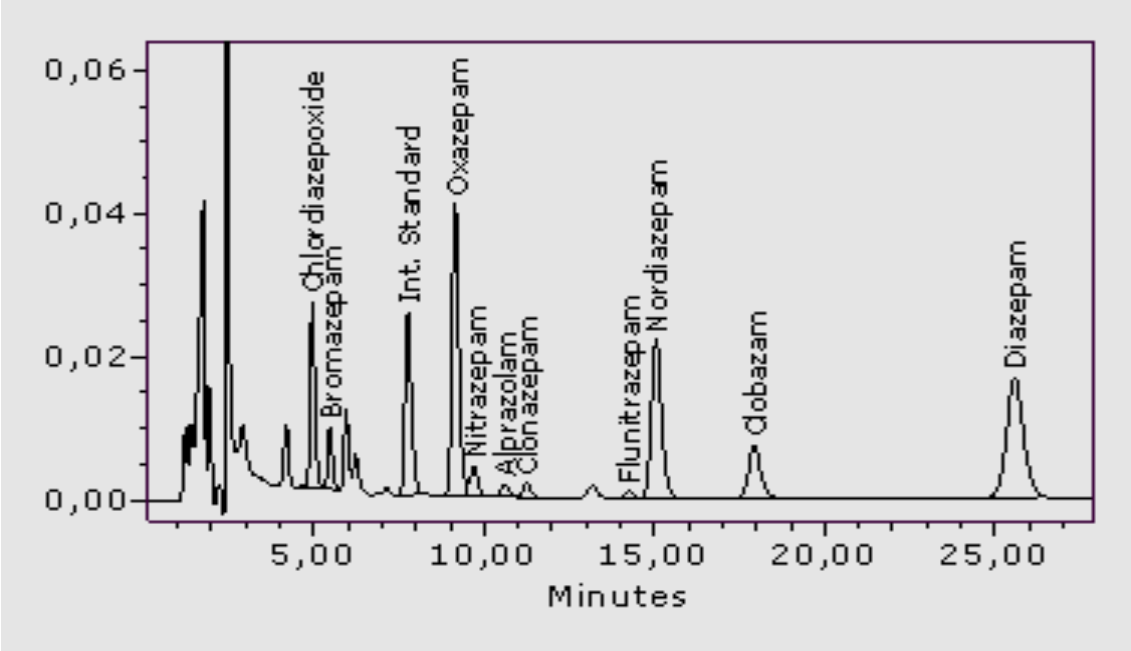
Amiodarone antiarrhythmic agent is used in various types of tachyarrhythmias, both ventricular and supraventricular (atrial) arrhythmias. In therapy, its potent effectiveness can lead to strong negative side effects, so regular monitoring of amiodarone serum levels is essential. Amiodarone is intended for use only in patients with the indicated life-threatening arrhythmias because its use is accompanied by substantial toxicity. Amiodarone has several potentially fatal toxicities, the most important of which is pulmonary toxicity (hypersensitivity pneumonitis or interstitial/alveolar pneumonitis). Liver injury is also common with amiodarone, but is usually mild and evidenced only by abnormal liver enzymes. Like other antiarrhythmics, amiodarone can exacerbate the arrhythmia, *e.g.* by making the arrhythmia less well tolerated or more difficult to reverse.



Accurate high performance liquid chromatography analysis of amiodarone and desethylamiodarone in plasma is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Benzodiazepines in Serum/Plasma

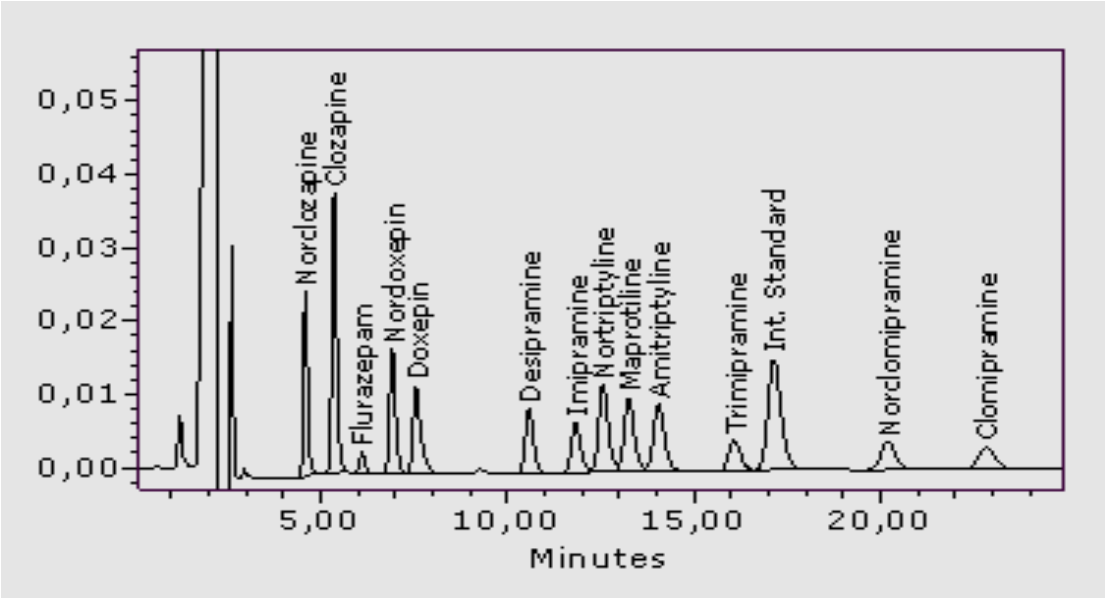
Benzodiazepines are sedative-hypnotic agents that are commonly used for seizure control, anxiety, alcohol withdrawal, insomnia, control of drug-associated agitation, as muscle relaxants, and as preanesthetic agents. They also are combined frequently with other medications for procedural sedation. Because of their widespread use, these drugs have propensity for abuse. In addition, benzodiazepines are frequently used in overdose, either alone or in association with other substances.



Accurate high performance liquid chromatography analysis of various benzodiazepines in plasma is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Antidepressants
Tricyclic Antidepressants in Serum/Plasma

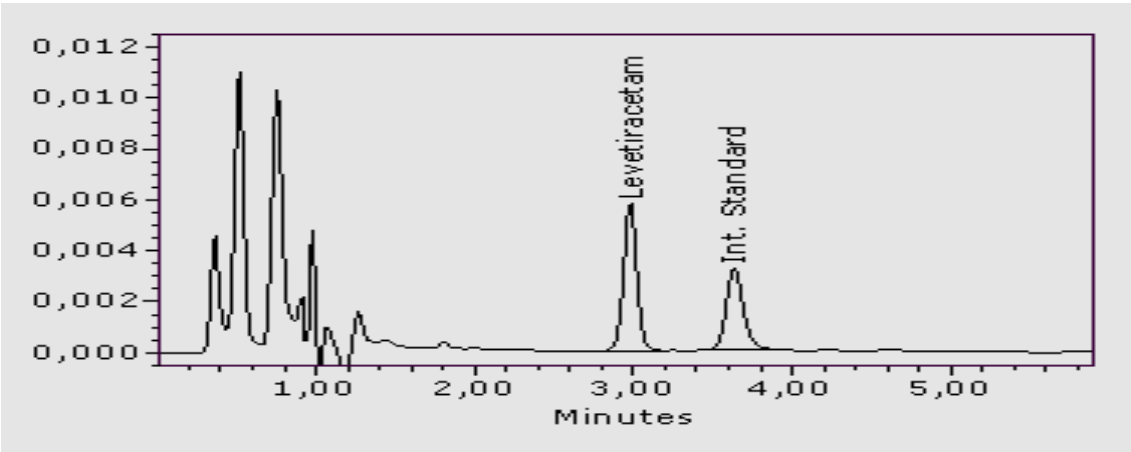
Tricyclic antidepressants are primarily used in the clinical treatment of mood disorders such as major depressive disorder, and bipolar disorder, especially in case of treatment-resistant variants. They are also used in the treatment of anxiety disorders such as generalised anxiety disorder, social phobia also known as 'social anxiety disorder', obsessive-compulsive disorder, panic disorder, post-traumatic stress disorder, attention-deficit, hyperactivity disorder, chronic pain, neuralgia, or neuropathic pain. Tricyclic antidepressants overdose is a significant cause of fatal drug poisoning. Severe morbidity and mortality associated with these drugs are well documented due to their cardiovascular and neurological toxicity. Additionally, it is a serious problem in the paediatric population due to their inherent toxicity.

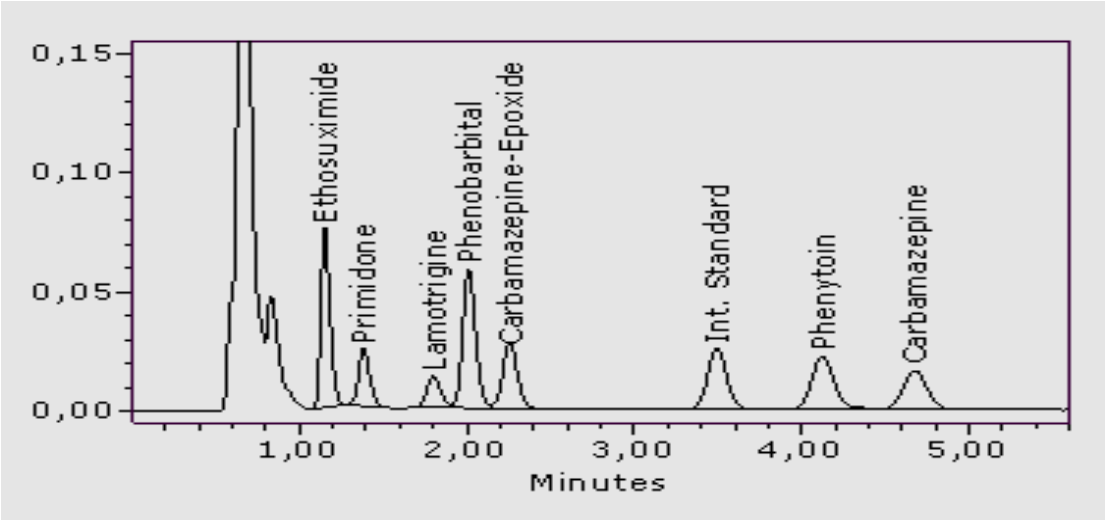


Accurate high performance liquid chromatography analysis of various antidepressants in plasma/serum is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Antiepileptics
Antiepileptic Drugs in Serum/Plasma

Antiepileptics are used in the treatment of epileptic seizures. They are also increasingly used in the treatment of bipolar disorder, since many seem to act as mood stabilizers. The goal of an antiepileptic is to suppress the rapid and excessive firing of neurons that start a seizure. Failing this, an effective anticonvulsant would prevent the spread of the seizure within the brain, and propose protection against possible excitotoxic effects that may result in brain damage.

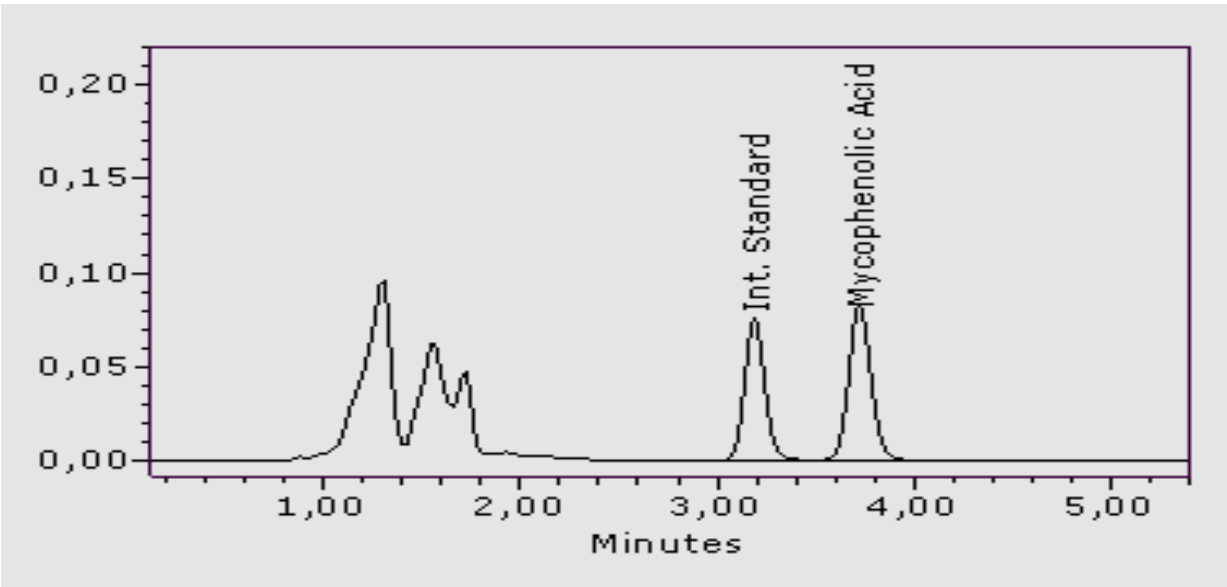




Accurate high performance liquid chromatography analysis of various antiepileptic drugs in plasma/serum is proposed by the Specialised Biochemistry Laboratory at HH-Princes Al-Jawhara Centre.

Immunosuppressants
Mycophenolic Acid in Plasma/Serum

Mycophenolic acid is an immunosuppressant drug used to prevent rejection in organ transplantation such as liver, heart, and lung. Unlike other immunosuppressant drugs, the therapeutic range for mycophenolic acid has not yet been established, but it is useful to determine its levels to monitor drug interaction with other immunosuppressants such as cyclosporine or tacrolimus in combination therapy, or to correlate with clinical symptoms and side effects.

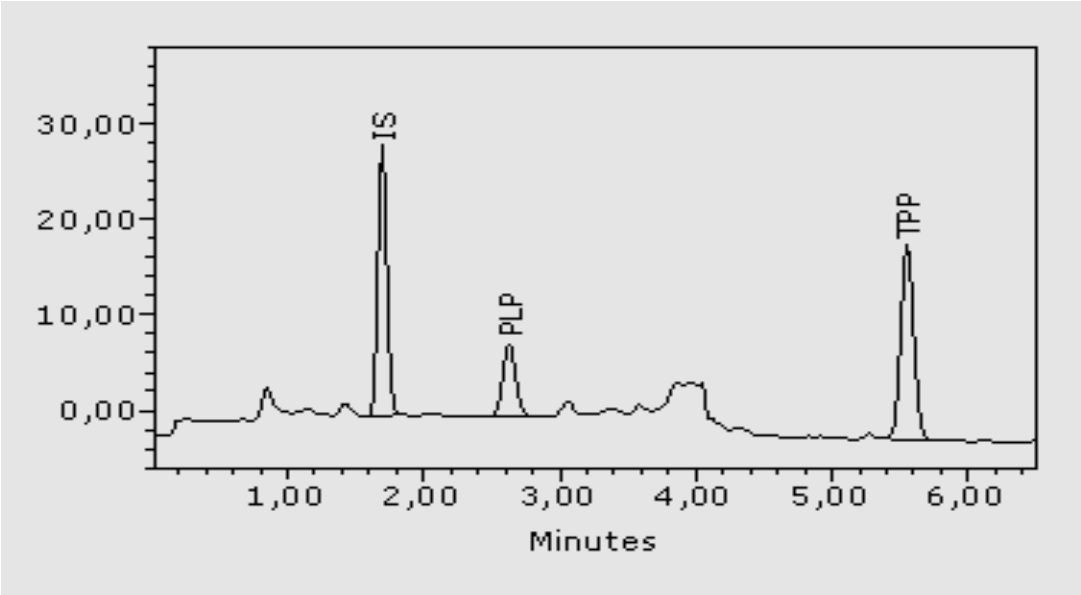


Accurate high performance liquid chromatography analysis of mycophenolic acid in plasma/serum is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Vitamin Profiling
Vitamin Profiling to Ensure a Healthy and Energetic Life for All Ages

Vitamin B_1 in Whole Blood

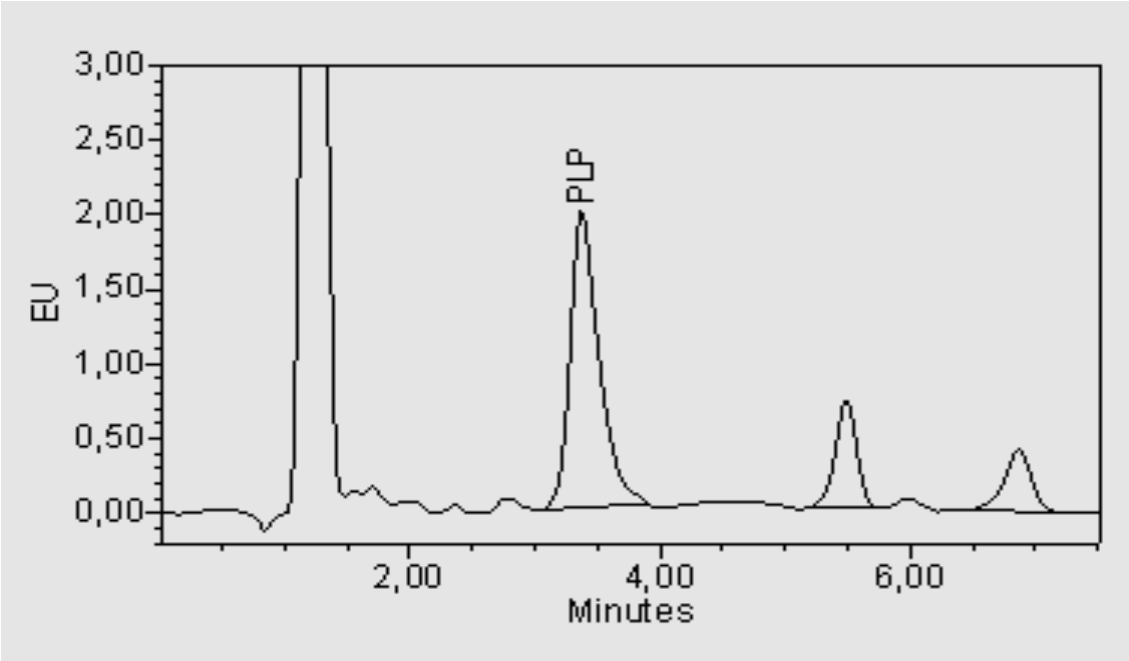
Vitamin B_1 (thiamin) is a water-soluble vitamin of the B complex. Thiamine is involved in the breakdown of energy molecules such as glucose, and is also found on the membranes of neurons. Plants are the main source of Vitamin B_1 for human and deficiency of this vitamin results in a condition called 'beriberi', affecting the peripheral nervous system (polyneuritis) and many other systems of the body. Symptoms of beriberi include severe lethargy and fatigue, together with complications affecting the cardiovascular, nervous, muscular, and gastrointestinal systems. Thiamin administration is the choice of treatment for vitamin B_1 deficiency. Thiamine pyrophosphate (TPP), a coenzyme, is the physiologically active form of vitamin B_1, thus the monitoring of the TPP is preferable to the analysis of total thiamine.



Accurate high performance liquid chromatography analysis of TPP in the whole blood is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Vitamin B_6 in plasma/serum and whole blood

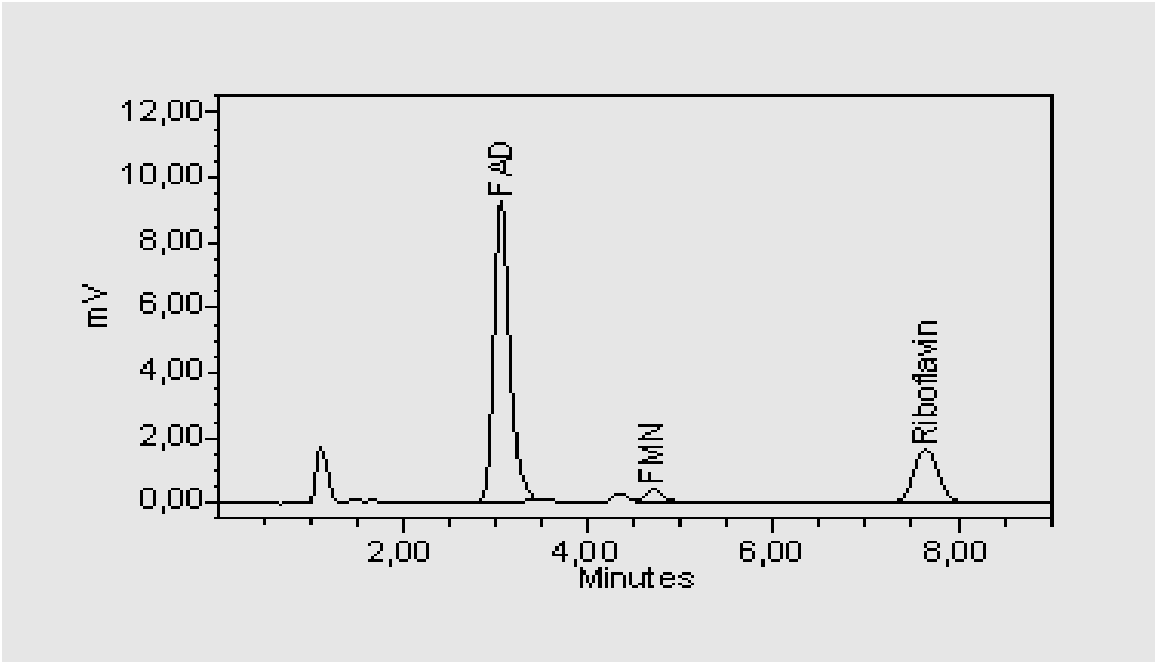
Vitamin B_6 is a water-soluble vitamin which is part of the vitamin B complex group. Pyridoxal phosphate (PLP) is its active form, and is a cofactor in many reactions of amino acid metabolism, including transamination, deamination, and decarboxylation. PLP also is necessary for the enzymatic reaction governing the release of glucose from glycogen. Pyridoxine, pyridoxal, pyridoxamine and their phosphates are shortly summarised as Vitamin B_6. PLP is involved in the production of neurotransmitters and hormones. The classic clinical syndrome for B_6 deficiency is a seborrhoeic dermatitis-like eruption, atrophic glossitis with ulceration, angular cheilitis, conjunctivitis, intertrigo, and neurologic symptoms of somnolence, confusion, and neuropathy.



Accurate high performance liquid chromatography analysis of PLP in the whole blood is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Vitamin B_2 (FAD, FMN, total Riboflavin) in Whole Blood

Riboflavin (vitamin B_2) belongs to the vitamin B complex, a heterogeneous group of water-soluble vitamins that are all precursors of coenzymes. It has a key role in maintaining health in humans. It is the central component of the cofactors FAD and FMN, and is therefore required by all flavoproteins. Vitamin B_2 is required for a wide variety of cellular processes and plays a key role in energy metabolism, and for the metabolism of fats, ketone bodies, carbohydrates, and proteins. Milk, cheese, leafy green vegetables, liver, kidneys, legumes such as tomatoes, yeast, mushrooms, and almonds are good sources of vitamin B_2. Riboflavin is best known visually as the vitamin which imparts the orange colour to solid B-vitamin preparations, and the yellow colour to vitamin supplement solutions. Riboflavin deficiency is classically associated with the oral-ocular-genital syndrome angular cheilitis, photophobia, and scrotal dermatitis.

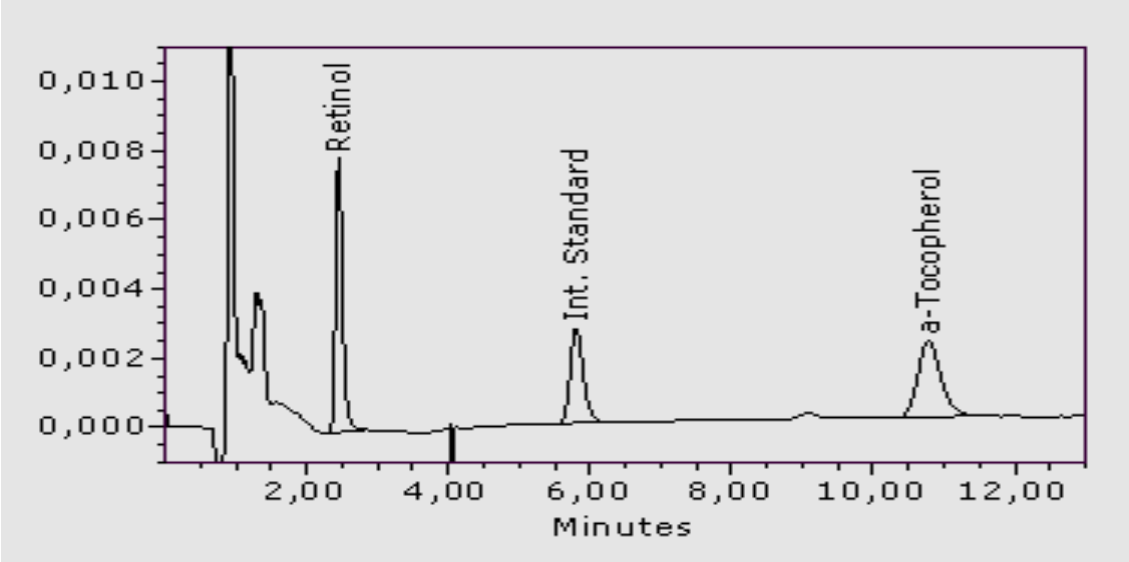


Accurate high performance liquid chromatography analysis of FDA, FMN and riboflavin in the whole blood is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Vitamins A and E in Serum/Plasma

Vitamin A is a vitamin which is needed by the retina of the eye in the form of a specific metabolite, the light-absorbing retinal molecule. This molecule is absolutely necessary for both scotopic and colour vision. Vitamin A also functions in a very different role, as an irreversibly oxidised form retinoic acid, which is an important hormone-like growth factor for epithelial and other cells. Vitamin A (retinol) is essential for the formation of rhodopsin, for bone metabolism, and for the synthesis of steroid hormones. Deficiency of vitamin A leads to night blindness, dry skin, and loss of hair. Persistent deficiency gives rise to a series of changes, the most devastating of which occur in the eyes.

Vitamin E (α-Tocopherol), as a potent antioxidant, protects LDL cholesterol and cellular membranes from lipid peroxidation, which mainly occurs as a result of increased oxidative stress in the organism. Vitamin E deficiency causes neurological problems due to poor nerve conduction. These include neuromuscular problems such as spinocerebellar ataxia and myopathies. Deficiency can also cause anaemia, due to oxidative damage to red blood cells.

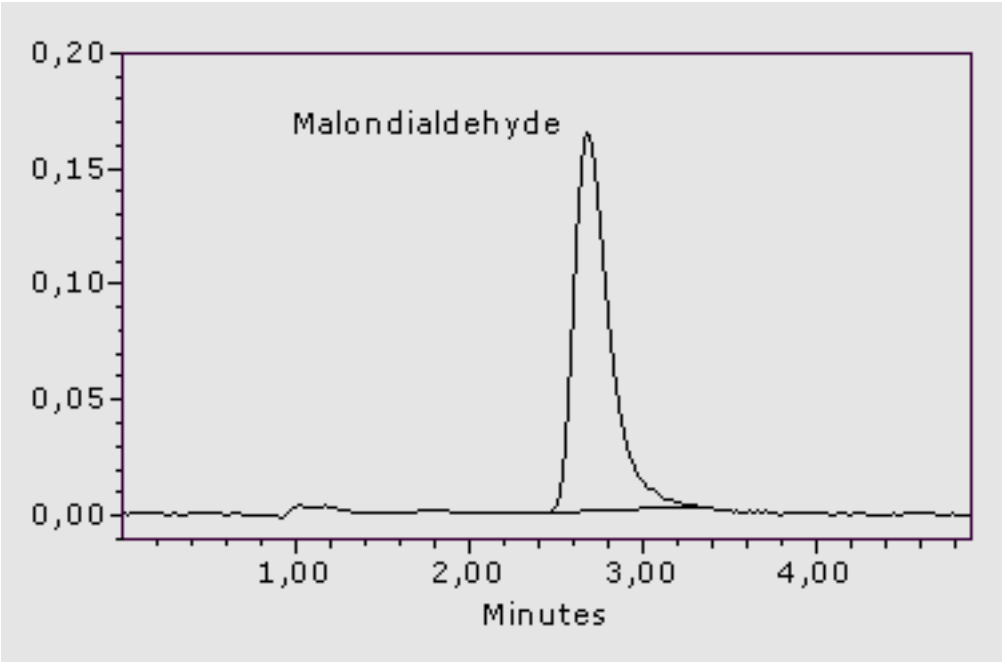


Accurate high performance liquid chromatography analysis of vitamin A and Vitamin E in plasma is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Monitoring Oxidative Stress

Malondialdehyde in Plasma/Serum

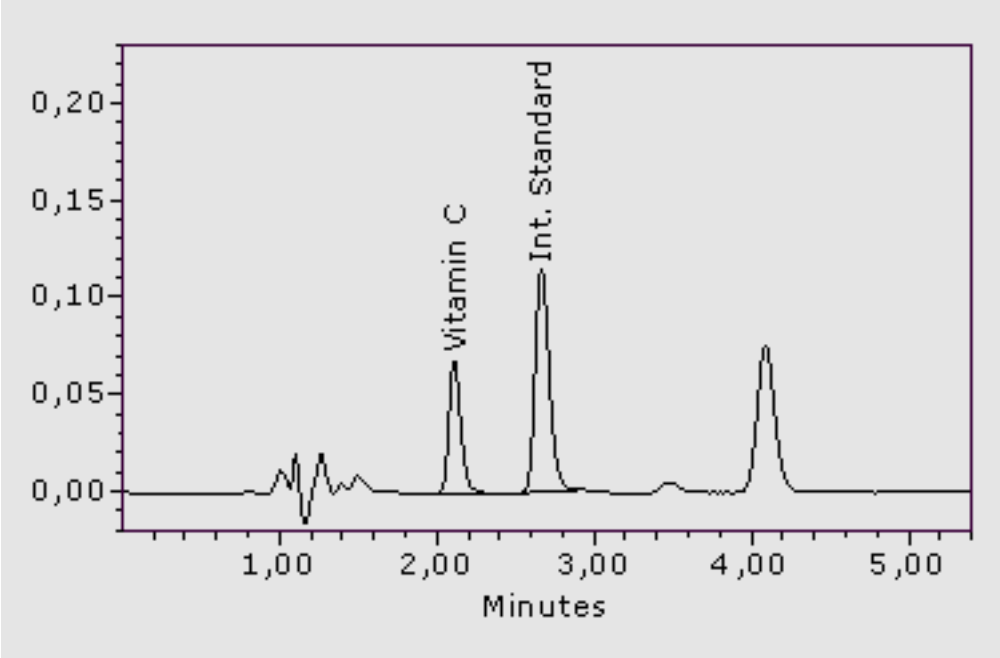
Reactive oxygen species breakdown polyunsaturated lipids to form malondialdehyde. This compound is a reactive aldehyde that causes toxic stress in cells. The production of this aldehyde is used as a biomarker to measure the level of oxidative stress. In addition malondialdehyde reacts with deoxyadenosine and deoxyguanosine in DNA, forming DNA adducts, which is mutagenic. Oxidative stress leads to considerable cellular damage (oxidation of lipids, proteins, and DNA). Patients suffering from keratoconus and bullous keratopathy have shown to increase levels of malondialdehyde. Malondialdehyde can also be found in tissue sections of joints from patients with osteoarthritis.



Accurate high performance liquid chromatography analysis of malondialdehyde in the whole blood is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Vitamin C in Plasma/Serum

Vitamin C, or L-ascorbic acid, is an essential nutrient for humans in which it functions as a vitamin. Ascorbate - an ion of ascorbic acid - is required for a range of essential metabolic reactions. Deficiency in this vitamin causes scurvy. Vitamin C also protects from reactive oxidants and acts as a co-factor in the hydroxylation of collagen. Scurvy leads to the formation of liver spots on the skin, spongy gums, and bleeding from all mucous membranes. The spots are most abundant on the thighs and legs, and a person with the ailment looks pale, feels depressed, and is partially immobilised. In advanced scurvy, there are open suppurating wounds, loss of teeth, and, eventually, death.

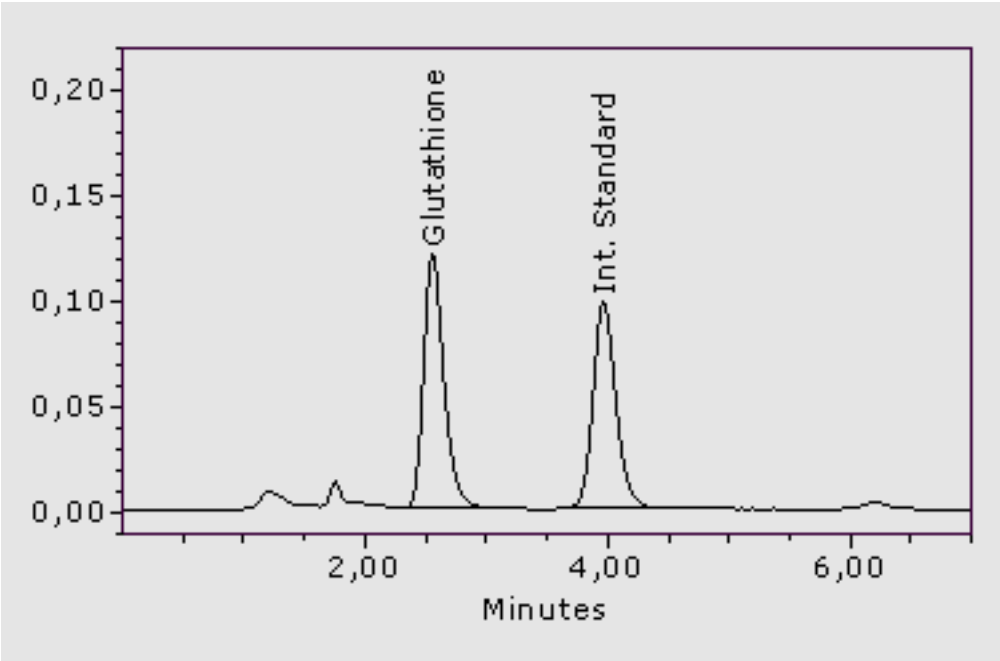


Accurate high performance liquid chromatography analysis of vitamin C in the blood/serum is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Glutathione in whole blood

Glutathione is an antioxidant that helps protect cells from reactive oxygen species such as free radicals and peroxides. Glutathione is nucleophilic at sulfur and attacks poisonous electrophilic conjugate acceptors.

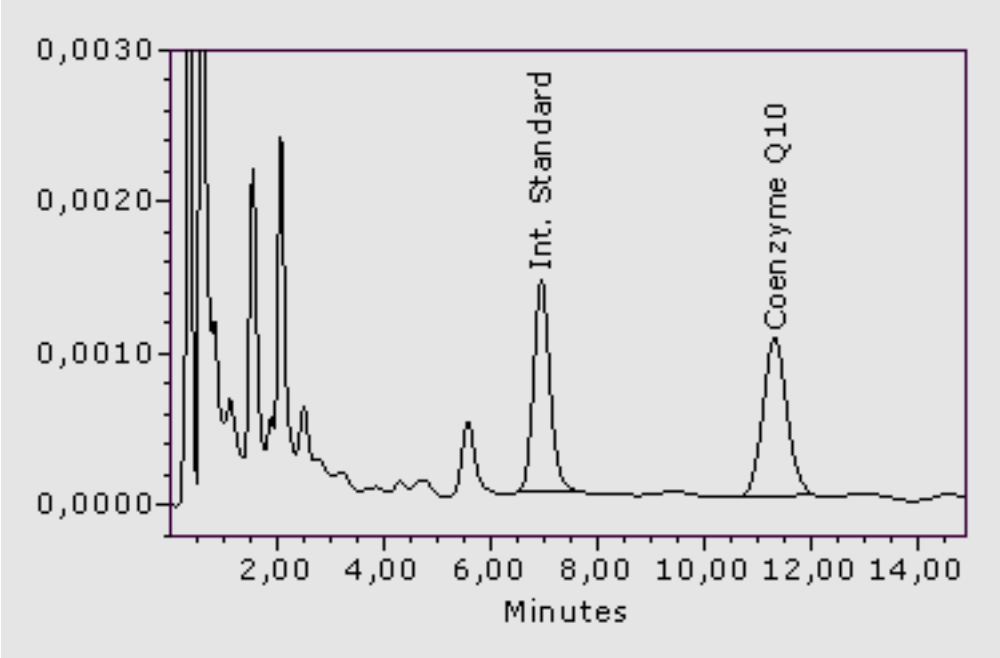
In the process, glutathione is converted to its oxidised form, glutathione disulfide (GSSG). Glutathione is found almost exclusively in its reduced form, since the enzyme that reverts it from its oxidised form, glutathione reductase, is constitutively active and inducible upon oxidative stress. In fact, the ratio of reduced glutathione to oxidised glutathione within cells is often used scientifically as a measure of cellular toxicity. It has numerous physical functions such as its implication in scavenging free radicals, and the formation of conjugates for the excretion of toxic xenobiotics for example. Low glutathione is also strongly implicated in wasting and negative nitrogen balance, notably as seen in cancer, AIDS, sepsis, trauma, burns, and even athletic overtraining.



Accurate high performance liquid chromatography analysis of glutathione in the whole blood is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Coenzyme Q_{10} in Serum/Plasma/Whole Blood

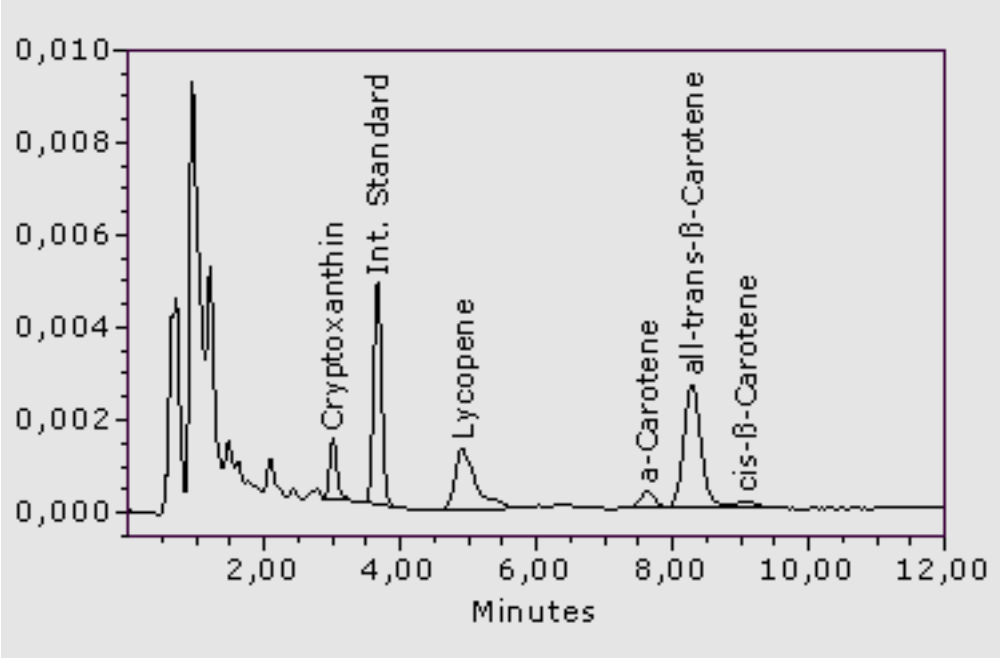
Coenzyme Q_{10} is a component of the electron transport chain and participates in aerobic cellular respiration, generating energy in the form of ATP. Ninety-five percent of the human body's energy is generated this way. Therefore, those organs with the highest energy requirements - such as the heart and the liver - have the highest CoQ_{10} concentrations. Coenzyme Q_{10} or ubiquinone is part of the mitochondrial respiratory chain and thus an important component of cellular energy production. In addition, it is a very effective radical scavenger, functioning as an antioxidant. Deficiency of coenzyme Q_{10} is, among other things, discussed as a possible cause of cardiac disease.



Accurate high performance liquid chromatography analysis of coenzyme Q_{10} in the serum/plasma/whole blood is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

β-Carotene in Serum/Plasma

β-Carotene is classified as a terpenoid. It is a strongly-coloured red-orange pigment abundant in plants and fruits. As a carotene with beta-rings at both ends, it is the most common form of carotene. It is a precursor (inactive form) of vitamin A. β-carotene has two roles in the body. It can be converted into vitamin A (retinol) if the body needs more vitamin A. If the body has enough vitamin A, instead of being converted, β-carotene acts as an antioxidant that protects cells from damage caused by harmful free radicals. β-carotene is considered a conditionally essential nutrient. β-carotene becomes an essential nutrient when the dietary intake of retinol (vitamin A) is inadequate.



Accurate high performance liquid chromatography analysis of caratones in the serum/plasma is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

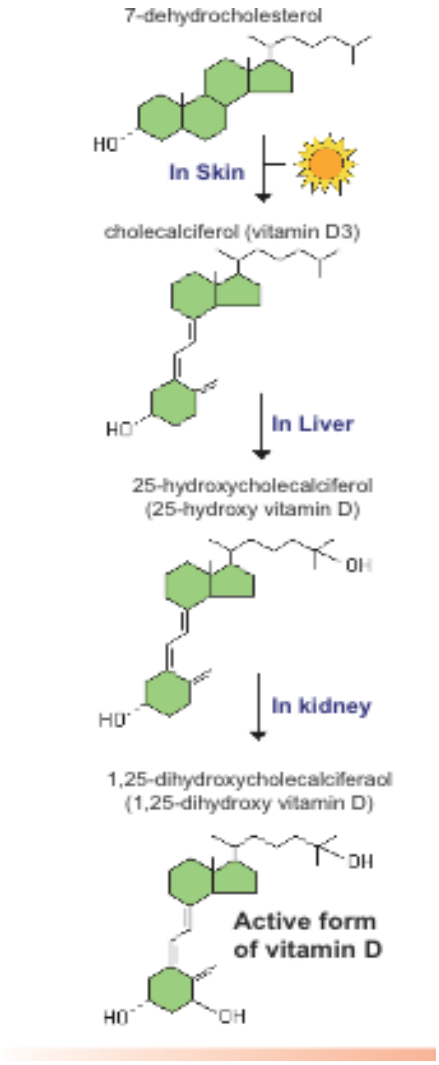
Vitamin D
Are We Getting Enough Vitamin D?

Analysis of Serum to Assess the Adequacy of Vitamin D

Vitamin D is the generic term for a group of fat-soluble sterol substances that have hormonal activity. Vitamin D compounds are derived from 3 sources: from plants as ergocalciferol (Vitamin D_2), from animals as cholecalciferol (Vitamin D_3), or by conversion of 7-dihydrocholesterol to Vitamin D_3 in the skin after ultraviolet exposure. These compounds are transported to the liver where they are converted to 25-hydroxyvitamin D_2 and D_3. The metabolites 25-hydroxyvitamin D_2 and D_3 have long half-lives and are the major circulating forms of Vitamin D. Both are equipotent pro-hormones that require 1-alpha-hydroxylation before expressing biological activity.

Vitamin D Production

Vitamin D is obtained from foods of animal origin and from ultraviolet light-stimulated conversion of 7-dehydrocholesterol in the skin. Vitamin D is converted in the liver to 25(OH) D_3 or calcidiol, the major circulating form of vitamin D. The enzyme 25(OH)D_3-1-alpha-hydroxylase in the kidney converts calcidiol to 1,25(OH)2D_3 or calcitriol, the most active form of vitamin D. Small amounts of vitamin D are also obtained from plant foods.



Biological Functions of Vitamin D

The Vitamin D Receptor (VDR) is a nuclear hormone receptor that is activated by the active form of vitamin D, calcitrol. VDR is expressed by most cells in every organ of the body. More than 200 genes are regulated by VDR activation. The primary role of vitamin D is to regulate blood levels of calcium and phosphorus by promoting absorption in the intestines and reabsorption in kidneys.

Calcium and phosphorus levels are important for bone mineralization and growth as well as for the prevention of hypocalcemic tetany. Vitamin D is also an important immune regulator. It promotes phagocytosis, anti-tumor activity, and immunomodulary functions that play a role in autoimmune disease. Additionally, vitamin D regulates cellular proliferation, differentiation, apoptosis and angiogenesis.

Vitamin D is most common vitamin deficiency in the Middle-East.

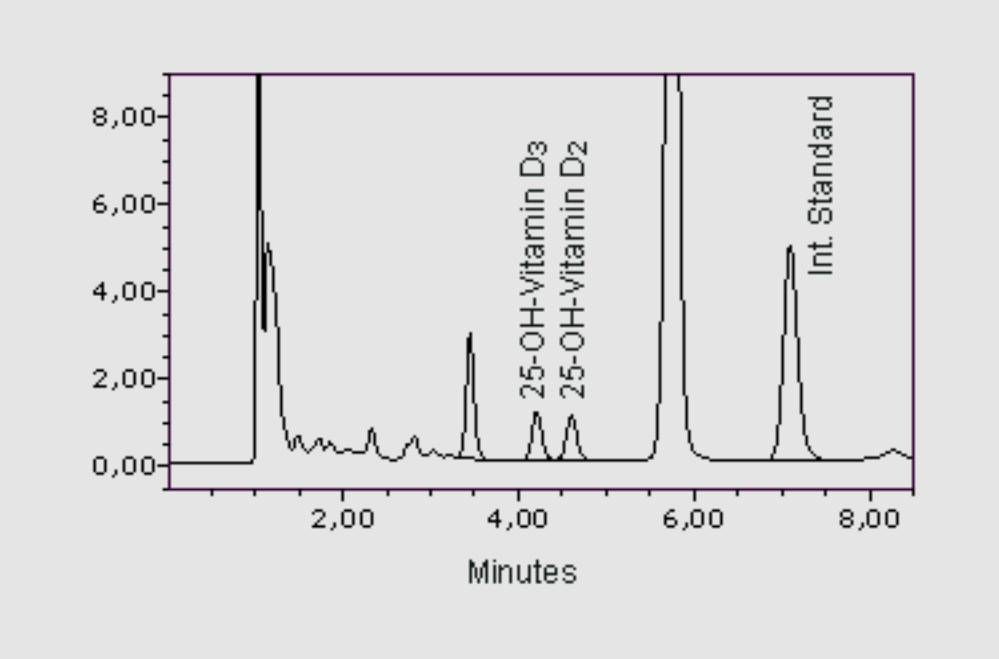
There are reports that vitamin-D-deficiency rickets is common in Middle-Eastern children in spite of abundant sunlight all through the year because children are wrapped up and kept indoors. Insufficient intake of vitamin D prolonged breastfeeding without supplementation and inadequate weaning practices are major important risk factors in the pathogenesis of vitamin D deficiency rickets in the region. Maternal education is important as it can influence all of the above factors. In addition, subclinical vitamin D deficiency among women with overt osteomalacia is common and suggesting a high prevalence of the disease among women in the region.

Indications for Vitamin D Testing

- Rickets, a childhood disease characterised by impeded growth, and deformity of the long bones. Rickets is a major public health problem in the Middle-East.
- Osteomalacia, a bone-thinning disorder that occurs exclusively in adults, is characterised by proximal muscle weakness and bone fragility. The effects of osteomalacia are thought to contribute to chronic musculoskeletal pain.
- Osteoprosis, a condition characterised by reduced bone mineral density and increased bone fragility.
- Problems with parathyroid gland functioning, since PTH is essential for vitamin D activation. When vitamin D, calcium, phosphorus, or magnesium supplementation is necessary, vitamin D levels are sometimes measured to monitor treatment effectiveness.
- Signs of depression or lack of energy.
- Persistent and nonspecific musculoskeletal pain.
- Individuals with medium to dark complexions, or who do not regularly receive 20 minutes of direct sunlight each day.
- Patients diagnosed with any of the vitamin D related diseases (cancer, diabetes, hypertension, heart disease, multiple sclerosis, systemic lupus erythematosus, depression, Alzheimer's, Parkinson's, epilepsy, and other diseases).
- Individuals taking Vitamin D supplementation greater than 50 mcg (2,000 IUs) per day.
- Infants that are exclusively breastfed, or children without a well-balanced diet.
- Overweight individuals with a BMI >25.
- Patients with gastrointestinal disease and/or who have had a cholecystectomy.
- Elderly individuals.

Analysis of 25-Hydroxyvitamin D_3 and 25-Hydroxyvitamin D_2 Metabolites
A Serum Assay to Assess the Adequacy of Vitamin D

Measuring the sum of 25 hydroxyvitamin D_2 and D_3 is the best indicator of a patient's vitamin D status. High performance liquid chromatography (HPLC) and liquid chromatography mass spectrometry (LC/MS) are the 'gold standard' for Vitamin D testing, proposing faster and more reliable results than all other laboratory testing methods. HPLLC or LC/MS separates D_2 from D_3, which allows assessment of the source of the deficiency, and also facilitates treatment monitoring.



Accurate high performance liquid chromatography analysis of 25-OH vitamin D_3 and 25-OH vitamin D_2 in serum is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Biogenic Amines
Screening for Phaeochromocytoma, Carcinoid Tumor and Depression

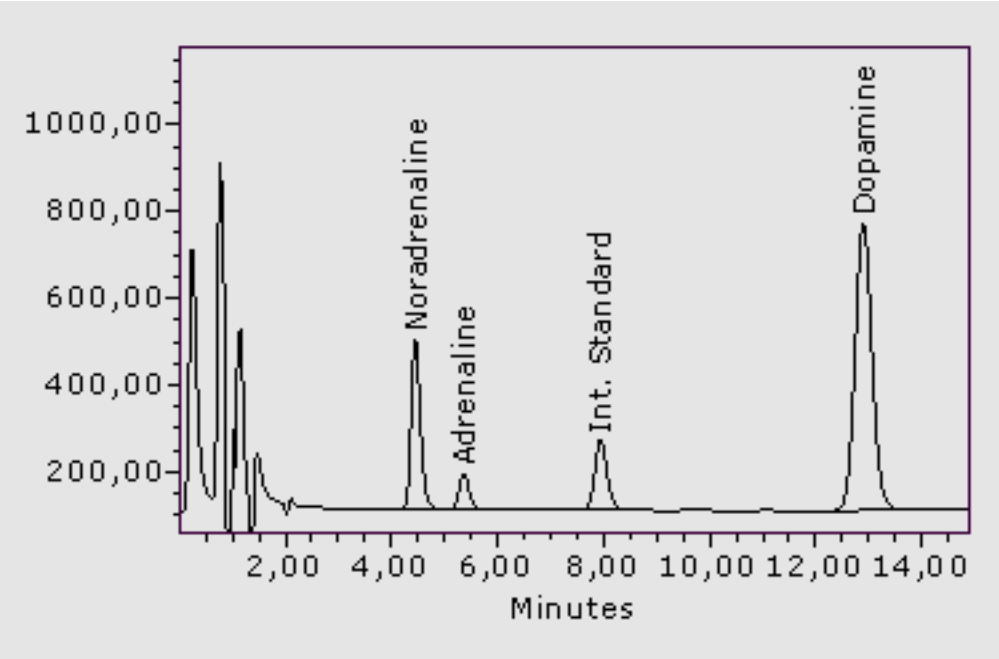
Catecholamines in Urine/Plasma

Catecholamines are released by the adrenal glands in response to stress. They are part of the sympathetic nervous system.

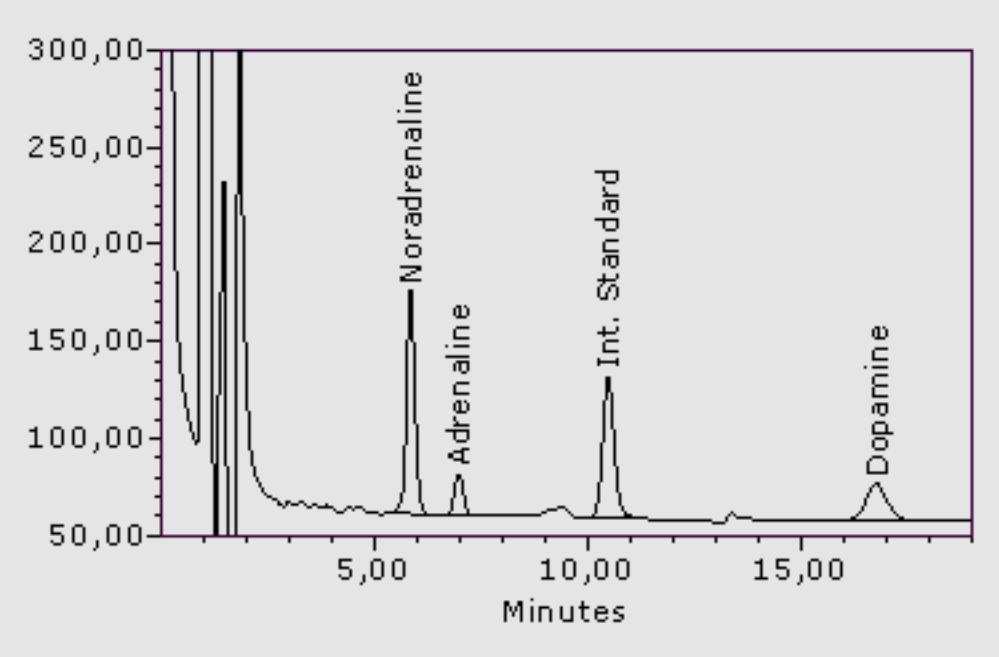
The most abundant catecholamines are epinephrine (adrenaline), norepinephrine (noradrenaline), and dopamine; all of which are produced from phenylalanine and tyrosine. Many catecholamines serve as structural motives for various stimulants. Catecholamines are water-soluble and are 50% bound to plasma proteins, so they circulate in the bloodstream.

Catecholamines such adrenaline, noradrenaline, and dopamine are secreted from

phaeochromocytomes, which are functional tumors derived from chromaffin cells of the adrenal medulla and paraganglions. Since normal chromaffin tissue produces biogenic amines too, it is essential to monitor the levels of these molecules. Significantly raised levels of adrenalin, noradrenalin, or dopamine are a clear marker for the presence of a phaeochromocytoma.



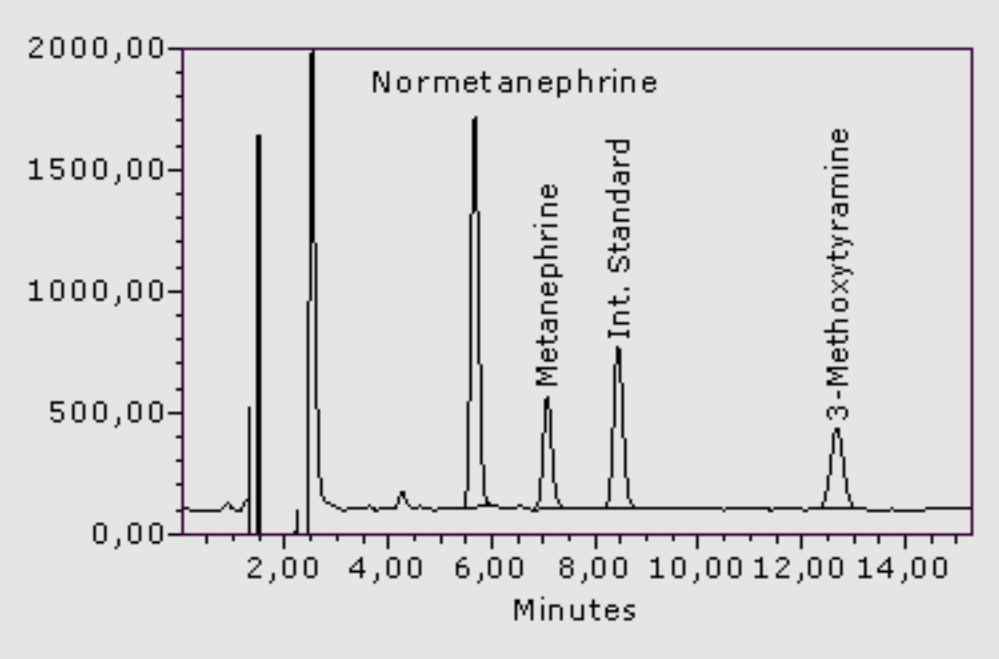
Accurate high performance liquid chromatography analysis of catecholamines in urine is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.



Accurate high performance liquid chromatography analysis of catecholamines in plasma is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Metanephrines in Urine

Metanephrine is a metabolite of epinephrine created by action of catechol-O-methyl transferase on epinephrine. The measurement of plasma free metanephrines is suggested to be the best indicator for diagnosis of pheochromocytoma.

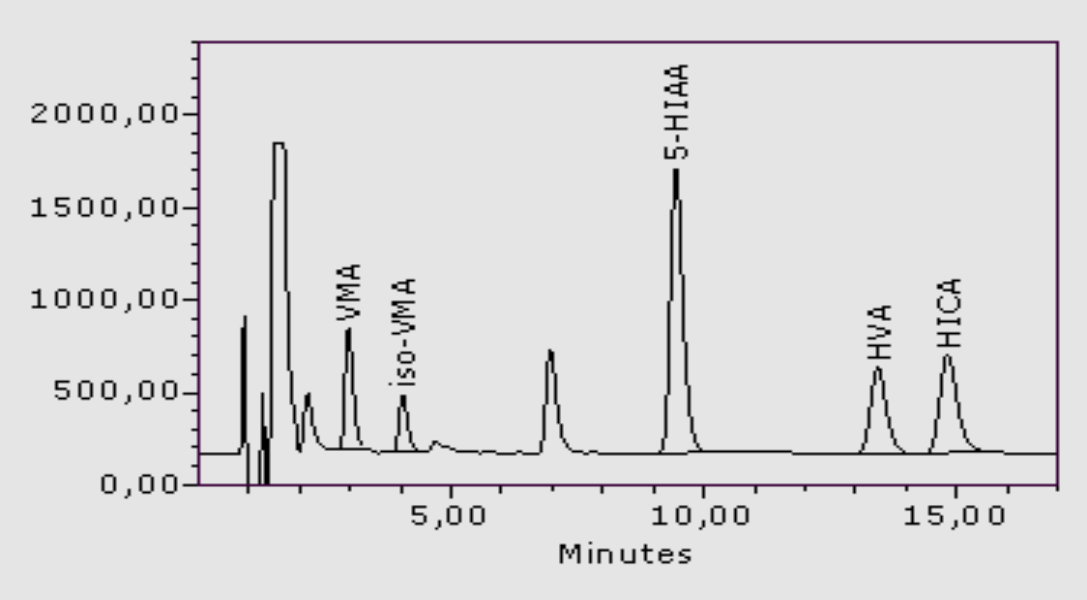


Accurate high performance liquid chromatography analysis of metanephrines in urine is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

VMA, HVA, 5-HIAA in Urine

Vanillyl mandelic acid (VMA) is an end-stage metabolite of epinephrine and norepinephrine. It is produced via intermediary metabolites. Urinary VMA is elevated in patients with tumors that secrete catecholamines. These urinalysis tests are used to diagnose pheochromocytoma. These tests may also be used to diagnose neuroblastomas, and to monitor treatment of these conditions. 5-Hydroxyindoleacetic acid (5-HIAA) is the main metabolite of serotonin in the human body. In chemical analysis of urine samples, 5-HIAA is used to determine the body's levels of serotonin. Neuroblastoma is a neoplastic disease of infants, and is the third most common cancer disease in children. Because of the close histological relationship of this tumor to the autonomic synthetic nervous system, these patients excrete increased amounts of the catecholamine metabolites vanillylmandelic acid (VMA) and homovanillic acid (HVA) into urine. The measurement of VMA and HVA serves as a screening test for neuroblastoma. The concentration of 5-hydroxyindolacetic acid (5-HIAA) in urine is a diagnostic marker

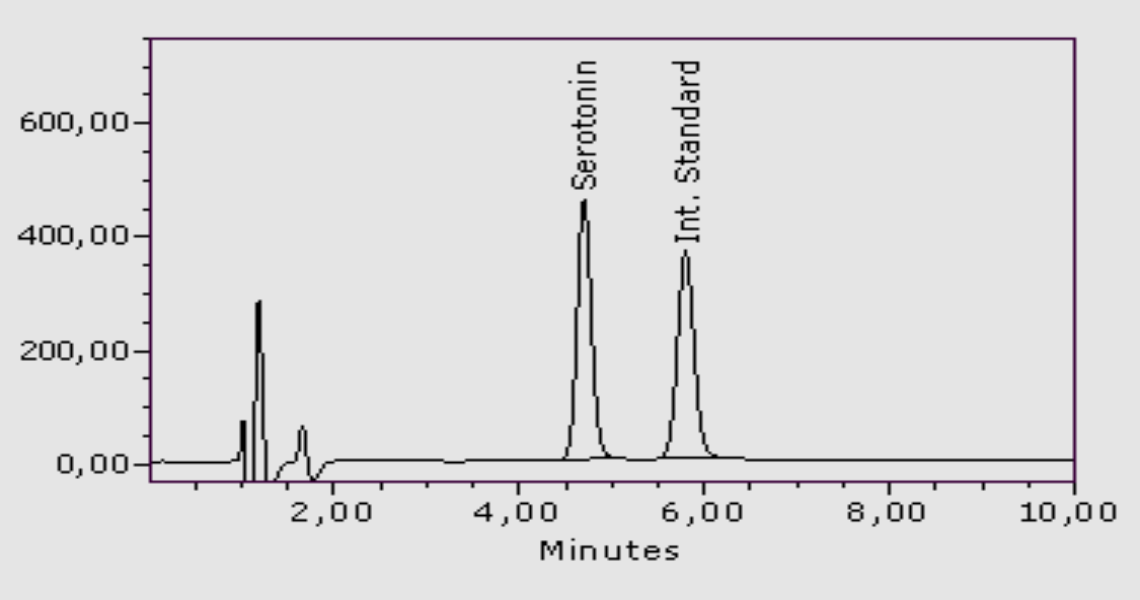
for the carcinoid syndrome. This malignant proliferation of the enterochromaffin cells of the gastrointestinal tract leads to an excessive production of the tissue hormone serotonin, the major metabolite of which is 5-HIAA.



Accurate high performance liquid chromatography analysis of VMA, HVA and 5-HIAA in urine is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

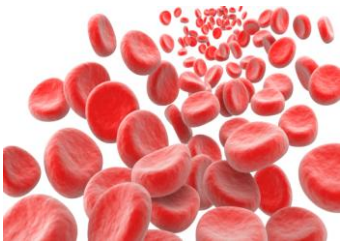
Serotonin in Urine/Plasma/Serum

Serotonin or 5-Hydroxytryptamine is a neurotransmitter that is primarily found in the gastrointestinal tract and central nervous system where it has various functions, including the regulation of mood, appetite, sleep, muscle contraction, and some cognitive functions including memory and learning. Modulation of serotonin at synapses is thought to be a major action of several classes of pharmacological antidepressants. Serotonin is metabolised to 5-HIAA by the liver, and excreted by the kidneys. Carcinoid tumor secretes large amounts of serotonin into the blood, which causes various forms of the carcinoid syndrome: flushing, diarrhea, and heart problems. Due to the serotonin's growth promoting effect on cardiac myocytes, persons with serotonin-secreting carcinoid may suffer a right heart (tricuspid) valve disease syndrome, caused by proliferation of myocytes onto the valve. The serotonin-test is also indicated for depression and schizophrenia conditions. For the diagnosis of carcinoids, the determination of 5-hydroxyindoleacetic acid (5-HIAA) in urine is recommended. However, if carcinoids generate only small amounts of serotonin, the determination of serotonin in serum can be a more sensitive indicator than serotonin or 5-HIAA secretion in urine.



Accurate high performance liquid chromatography analysis of serotonin in urine and plasma or serum is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.

Hemoglobin Testing
Screening for Hemoglobin Variants



Hemoglobin is the iron-containing oxygen-transport metalloprotein in the red blood cells. It transports oxygen from the lungs to the rest of the body where it releases the oxygen for cell use. Hemoglobin has an oxygen binding capacity between 1.36 and 1.37 ml O_2 per gram of hemoglobin, which increases the total blood oxygen capacity seventyfold.

Hemoglobin consists of four polypeptide chains. Globins and one hem molecule bound to each globin and genetic defects may lead to abnormalities of structures, thalassaemic syndromes, and the hereditary persistence of fetal Hb. This abnormal hemoglobin shows decreased function of different severity and, depending on the type of hemoglobinopathy, tendencies towards promoting vaso-occlusion by erythrocytes. The most severe clinical expressions are syndromes such as sickle cell anaemia, hypo-chromic anaemia, and familiar cyanose. These syndromes may be caused by different mutations, and an adequate therapy requires the exact identification of the hemoglobinopathy.

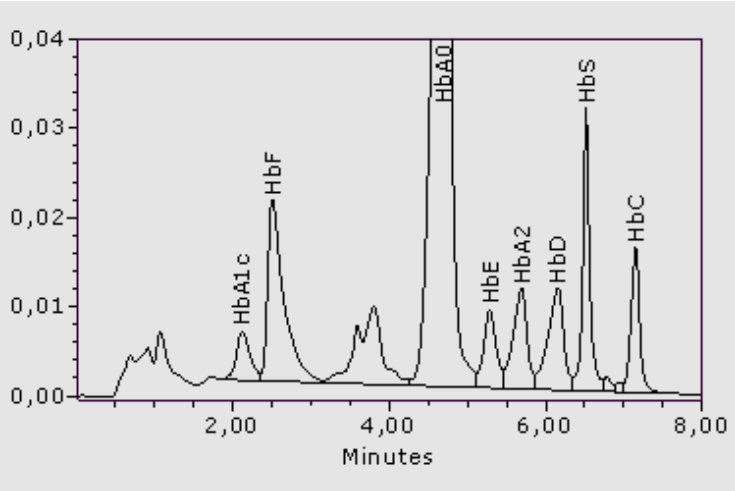
Some of these will not be eliminated by symptomatic therapy such as blood transfusion, but require laborious approaches such as bone marrow transplantation. However, carriers of the genetic defects may minimize the manifestation of the disease by an adapted lifestyle, thus an early diagnosis, especially for children, is of paramount importance.

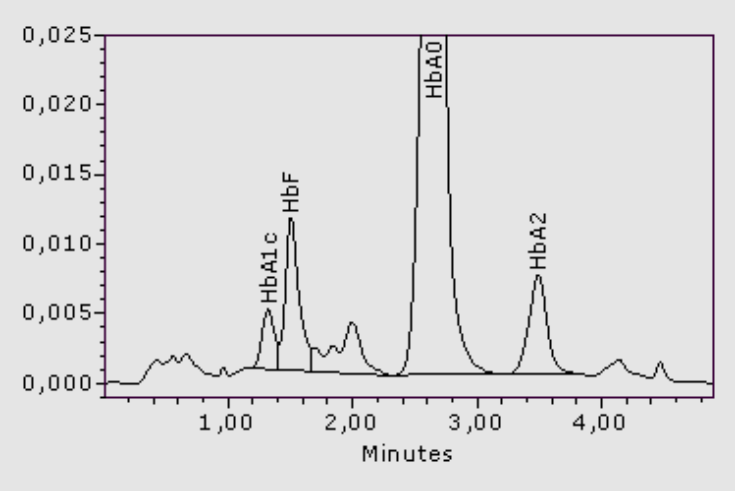
Thalassaemia is an inherited autosomal recessive blood disorder. The genetic defect in thalassaemia is associated with reduced rate of α and β-globin chains synthesis that is essential for formation of hemoglobin. Consequently the reduced synthesis of α or β- globin chains can cause the formation of abnormal hemoglobin causing anaemia, the main characteristic presenting symptom of the thalassemias. Thalassemias are classified according to which chain of the hemoglobin molecule is affected. In α thalassemias, production of the globin chain is affected, while in β-thalassemia production of the β-globin chain is affected. B-thalassemias are common in Africans, but also in Greeks, Italians, and Arabs. The most frequently affected globin chain is the β-chain (β-thalassemia). In patients homozygotic for this defect, the β-chain is not synthesised at all; in heterozygotic patients, the synthesis is reduced by about 20 %. Compensation is achieved by increased synthesis of HbA_2 or HbF.

Besides thalassemias, in which the synthesis of the globin chains is disturbed, mutations in the globins can occur. These lead to abnormal hemoglobin variants. The most frequent and clinically important hemoglobin variants are HbS, HbC, and HbE. Another relatively frequent variant is the HbD. Occurrence of thalassemias in combination with other genetically determined hemoglobin abnormalities is also possible.

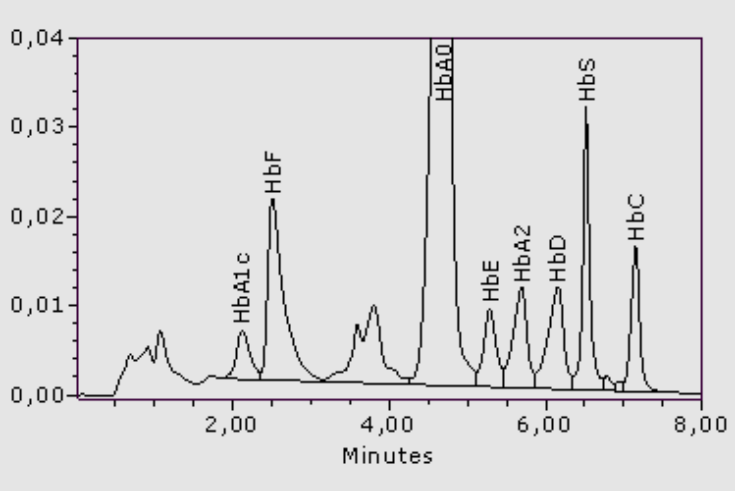
Glycated hemoglobin is formed in a non-enzymatic pathway by hemoglobin's normal exposure to high plasma levels of glucose. Hemoglobin A1c used primarily to identify the average plasma glucose concentration over prolonged periods of time. Glycation of hemoglobin has been associated with cardiovascular disease, nephropathy, and retinopathy in diabetes mellitus. Monitoring the HbA_{1c} in type-1 diabetic patients may improve treatment.

In Al-Jawhara Centre Specialised Biochemistry Unit, most variants of hemoglobins are analysed in the whole blood, using the most sophisticated analytical systems.





Accurate high performance liquid chromatography analysis of HbA1c, HbF and HbA2 is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.



Accurate high performance liquid chromatography analysis of HbE, HbD, Hbs and Hbc in the blood is proposed by the Specialised Biochemistry Laboratory at Al-Jawhara Centre.