

Health Risk Profiles

The VHL Health Risk Profile is a group of tests designed to identify biochemical abnormalities associated with an increased risk of disease with a focus on nutritional aspects of health and wellbeing. It should be used in conjunction with routine pathology and clinical assessment of patients.

Many of the tests included in the profile relate to protective factors, such as antioxidants, trace elements, vitamins and fatty acids. Some tests are included because they identify abnormalities associated with the early stages of disease. Most of these factors can be modified by diet and lifestyle reversing and reducing disease risk, so the Health Risk Profile is a recommended tool for nutritional screening and monitoring.

The basic profile is also offered with additional markers as the “*Health Risk Profile Plus*” which includes additional risk factors for long-term health.

The specialist nature of some of the investigations in these profiles increase the turnaround time beyond our rapid routine pathology investigations, but we endeavour to deliver all results as promptly as possible (within 1 week).

Within the basic profile there are 5 panels of tests:

- Biochemistry Screen with lipids
- Key minerals
- Vitamins
- Fatty acids
- High Sensitivity C-Reactive Protein and glycosylated haemoglobin (HbA1c)

The extended profile additionally includes:

- Apolipoproteins A1 & B
- Thyroid Hormones
- Prostate Panel/Ovarian Cancer Markers

The profiles enable the assessment and monitoring of factors contributing to a broad range of health parameters including cardiovascular health, immunity, liver and kidney function, metabolic syndrome gut function and nutritional & antioxidant status.

Minerals

The elements measured in the Health Risk Profile are plasma zinc, copper, selenium and red cell magnesium as a marker of intracellular magnesium reserves. Iodine is additionally included in the *Health Risk Profile Plus*. Mineral deficiencies can develop over many years in marginally deficient diets and can have a significant impact on health risks.

Zinc

There are now more than 300 known zinc-dependent enzymes and more than 2,000 zinc-dependent transcription factors in humans. Historically it was considered improbable that zinc deficiency could cause significant clinical problems, but now it is well established that the effects of zinc deficiency can be extensive and include dermatitis and delayed wound healing, poor growth, poor development of

cognitive function, poor immune function, chronic eye disease, and multiple consequences of poor cell division and growth throughout the body.

Copper

Copper is a co-factor for many enzymes including important antioxidant enzymes (e.g. superoxide dismutase and caeruloplasmin) and its deficiency results in defective activity of these enzymes. Copper levels can be impacted by zinc supplementation due to competitive absorption. Associations with low copper levels include hypercholesterolemia and hypertension, reduced immunity, neurological disease and an increased osteoporosis risk, along with an association with arthritis. Increased levels accumulate in the liver, kidneys and brain.

Selenium

The biological functions of selenium in humans include enhancement of the immune response (it enhances IL-2 receptors and plasma levels of selenoproteins P and W), protection of DNA from peroxidation and adduct formation (GSHPx), acting as an anti-viral agent and as an inhibitor of tumour growth, and also plays a role in mood control. There are at least 30 human selenoproteins, many with functions that remain unknown.

Magnesium

Magnesium has various important physiological functions; it is a cofactor for DNA and protein synthesis, for oxidative phosphorylation and for many enzymes. It is also a co-factor for more than 300 different metabolic reactions, particularly those involved in energy use and storage. Magnesium also functions as a calcium antagonist and is required for neuromuscular excitability, as well as, for example, regulation of parathyroid hormone (PTH) secretion. Magnesium deficiency is one of the most common elemental deficiencies seen in nutritional practice.

Iodine

Iodine is required for the synthesis of thyroid hormones and therefore has wide-ranging metabolic influences and with limited storage ability a regular intake is essential. The primary dietary source is seafood, but there is widespread deficiency presenting a significant public health problem in Western populations.

Vitamins

Vitamins included in the profiles are:

- Vitamin A (retinol),
- Vitamin E (tocopherol)
- Beta-carotene
- Vitamin D

We regularly observe deficiencies of vitamin E, reflecting poor dietary intake. Circulating levels of vitamin A and carotene reflects an individual's dietary choices which are frequently nutritionally inadequate. In contrast, elevated levels of vitamin A are sometimes seen reflecting excessive supplementation (either from individual or 'multi' supplements) or displacement of the vitamin from hepatocytes as a consequence of chronic alcohol consumption. Raised levels increase bone disease risk and this appears more pronounced in obesity or vitamin D deficiencies.

Vitamin D

The serum concentration of 25-hydroxy vitamin D is the most sensitive and useful index of vitamin D status. There is a seasonal variation in 25-hydroxy vitamin D in temperate regions of the globe, with lower levels prevalent in the winter (due to the lack of sunshine). There is currently much interest in

the non-bone physiological roles of vitamin D. Diseases in which there is a proposed association with low vitamin D levels include diabetes mellitus, metabolic syndrome, cardiovascular disease, myocardial infarction, hypertension, obesity, heart failure, inflammatory bowel disease, multiple sclerosis, psoriasis, tuberculosis, upper respiratory tract infections, polycystic ovarian syndrome, and several types of cancer. There is good evidence that vitamin D deficiency is a significant risk-factor for cardiovascular disease and impaired resistance to various types of infection.

Fatty acids

A range of omega-6 and omega-3 essential fatty acids are measured. Deficiencies of Omega-6 or 3 series essential fatty acids may be identified, although low intake of omega-3 fatty acids is specifically recognised as a major shortfall in the typical UK diet. The *Omega 3 Index* is reported reflecting the frequent imbalances between the fatty acid groups. Fatty acid disturbances are established risk factors for cardiovascular disease, mental health problems, cancer risk along with many others are proposed in the medical literature.

Lipids & Lipoproteins (Health Risk Profile Plus)

The assessment of lipid and lipoprotein levels is an important consideration when assessing heart disease and cardiovascular risks, but also for diabetes mellitus, hypothyroidism, renal and liver health amongst others.

Enzymes

The profiles includes a Biochemistry Screen with a number of useful enzyme levels:

- Serum alkaline phosphatase
- Serum lactate dehydrogenase
- Serum gamma-glutamyl transferase

Alkaline phosphatase is a useful marker of osteoblastic activity and also of possible hepatobiliary obstruction.

The activity of lactate dehydrogenase, and gamma-glutamyl transferase may reflect hepatocellular damage and microsomal enzyme induction. Liver enzyme levels are sensitive markers of hepatic health and are reliable indicators for excessive alcohol and recreational drug use (and self-medication using Paracetamol etc.), non-alcoholic fatty liver disease (NAFLD) and metabolic syndrome, hepatitis and others. Lifestyle changes can positively impact liver function with long term health benefits.

Lactate dehydrogenase (LDH) can originate from the cytoplasm of almost any cell in the body and hence increased LDH activity in the serum can also suggest leakage from non-hepatic tissues (especially tumours) if levels of the other enzymes are normal.

Proteins

Plasma albumin levels are partially dependent on protein intake and absorption; albumin levels also depend on other causes of impaired albumin synthesis, such as liver damage and the rate of albumin metabolism (which increases in inflammation). Serum globulins levels largely reflect variations in the gamma globulin fraction (IgG, IgA, IgM, IgD and IgE) which increase in hepatic disease and other inflammatory disorders.

High sensitivity C-Reactive Protein

An elevated high sensitivity C-Reactive protein (CRP) level is indicative of an inflammatory process and more usefully chronic inflammation which poses an increased risk for many diseases. It is now thought that CRP is a not only a marker of atherosclerotic disease but plays a role in its pathogenesis.

Haemoglobin A1c

Measurement of glycated haemoglobin (HbA1c) reflects the glucose concentration in the plasma over the preceding three months. Glucose binds to haemoglobin at a rate that reflects the plasma glucose level at any one time. The formed glycosylated haemoglobin circulates for the lifespan of the red blood cell, thus giving an indication of diabetes risk. Blood HbA1c concentration is the best method of screening for diabetes mellitus. Dietary interventions have been shown to have a significant impact on the progression of Type 2 Diabetes.

Interpretation of results

The Health Risk Profile reports are best interpreted in conjunction with clinical data, drug and nutritional supplement history, diet and lifestyle data. Our Biomedical Scientists are available to provide further support in interpreting the results. Reference intervals for all the analytes measured are shown on the reports, optimal levels are likely to be well within the quoted reference intervals for micronutrients.

Patient preparation

Patients should discontinue nutritional supplements for 24-48 hours before the collection of blood samples and they should fast overnight for a minimum of 12 hours (water is permitted). 24 hours avoidance of seafood is also recommended to establish a reliable baseline for iodine levels in the Health Risk Profile Plus.

Specimen requirements

Health Risk Profile

- 2x Serum separator tubes (Yellow), 2x EDTA (Purple), 1x trace element free (Navy).

Health Risk Profile Plus

- 3 x serum separator tubes (Yellow), 2x EDTA (Purple), 1x trace element free (Navy) and 1x 30mL urine

Sample collection tubes are available from VHL on request. Blood samples must reach us within 24 hours of collection.

Turnaround time

7 working days for all results (most are completed and reported within the first 3-days, but the more specialised work takes longer).

Additional tests for consideration:

Additional tests that are considered helpful in assessing risk of disease include the following (these tests are not included above to optimise the value of these profiles and to ensure suitability for postal submission of samples).

Homocysteine

There is an inverse relationship between plasma homocysteine and folic acid, vitamins B12, B2 (riboflavin) and B6 (pyridoxine); the current concern is that deficiencies of folic acid, vitamin B12 and

vitamin B6 can contribute to moderate hyper-homocysteinemia, which is a risk factor for coronary heart disease and a variety of other conditions, including cognitive decline. Plasma homocysteine concentrations can therefore be read as a functional marker of the deficiency of these vitamins and its measurement is indicated in subjects with micronutrient deficiencies or at risk from vascular disease or cognitive decline – a substantial proportion of the ageing population. The measurement of homocysteine should ideally be carried out in non-fasting subjects since it is potentially produced in response to a dietary methionine load although many laboratories stipulate fasting levels for which reference ranges have been established. This test may therefore require a second venipuncture appointment, since the other Health Risk Profile analytes are best measured in fasting samples.

B Vitamins

Deficiencies of vitamins B1, B2 and B6 are extremely common among the “chronically sick” population, usually due to poor intake, but also due to increased utilisation and wasting – for example caused by alcohol consumption. Deficiency can develop because of poor diet, alcohol excess, malabsorption, vomiting or due to the increased needs of pregnancy. Deficiency can develop over a few weeks, especially in cases of alcohol excess or illnesses characterised by weight loss. The group as a whole are involved in energy metabolism, the breakdown and formation of proteins, the formation of blood cells and the health of the mouth and the gut. Early features of B vitamin deficiency therefore include fatigue, a sore tongue, recurrent mouth ulcers, mood changes, numbness and tingling in the hands and feet, loss of balance, skin changes and diarrhoea. Severe deficiencies affect the nervous system and heart. Many deficiencies are easily rectified with oral supplementation and dietary changes.

Vitamin B12 (“Active”) and Red Cell Folate

Vitamin B12 and folate deficiencies develop over extended periods and increase in frequency with age. Dietary choices, gut function, pharmaceutical medications and genetic predisposition can lead to deficiencies resulting in decreased energy, neurological and oral symptoms, and pernicious anaemia.

Gut Microbiome – Stool Analysis

Imbalances in the diversity and balance of the microbiome resulting from gut infections, parasitic infections, plant restricted diets and low dietary fibre intake are increasingly associated with many chronic health problems including mental health problems and autoimmune conditions. The fermentation of dietary fibre produces important vitamins (K and B vitamins), influences hormone activity and produces neurotransmitters. The GI360 series of stool profiles provides an analysis of the microbiome bacterial content including a graphical illustration of its deviation from a normal distribution.

Small Intestinal Bacterial Overgrowth (SIBO)

Patients with long term gut/digestive complaints (often diagnosed as IBS) are likely to have disturbed gut absorption leading to suboptimal micronutrient status. SIBO is estimated to be present in the majority of these patients and should be considered (VHL offer a straightforward breath gas testing solution for diagnosing abnormal gut bacterial fermentation activity).

Adrenal Stress Profile

A series of saliva samples collected through a 24-hour period are analysed for their cortisol level as an indicator of the effects of stress and adrenal function. Low and high early morning cortisol levels, and reduced cortisol metabolism through the day are associated with many disease processes and are a further useful screen for risks to health. Lifestyle changes can have a noteworthy impact on adrenal function.

Toxic Metal, Chemicals & Mycotoxins

Exposure to environmental toxins from the atmosphere, occupational, domestic, personal and dietary exposures can have a long-term impact on health and wellbeing and historical exposure can still result in detectable levels many decades later. Many toxin levels increase with age suggesting exposures exceed excretory capacity. Toxins increase free-radical activity and thus demands on antioxidant activity and micronutrients, increase demands on the liver and kidneys and block enzyme activity (e.g. mineral receptors blocked by toxic elements). All exposures to toxins have a detrimental impact on health.

Humans have not yet adapted to toxins distributed in the environment by human activity since the industrial age and we are all exposed to many hundreds of these on a daily basis.

Mycotoxins, toxins from moulds, are increasingly associated with health problems due to hidden mould in both well and poorly maintained homes (inadequate ventilation in warm but damp rooms), the workplace, vehicles and fungal growth on foods undergoing extended transit times with inadequate preparation before consumption. Surface mould on windows and in bathrooms and kitchens can be a sign of hidden mould behind walls or fittings which are inaccessible. Many chronic health problems have been associated with exposure to mycotoxins and it should be an important consideration when assessing patients with symptoms of unknown origin.