



HEALTH RISK PROFILE

August 2019

Introduction

The Biolab Health Risk Profile is a nutrition-related group of tests designed to identify biochemical abnormalities associated with an increased risk of disease. It does not replace routine biochemistry and haematology profiles or the clinical assessment of the patient.

Most of the tests included in the profile relate to protective factors, such as antioxidants, trace elements, vitamins and fatty acids. However, some tests are included because they relate to abnormalities associated with the early stages of disease, for example sensitive tests of liver function – which are not part of hospital biochemistry profiles because they give positive results in subjects who have yet to develop overt disease. All these factors can be modified by diet and so the Health Risk Profile is very suitable for nutritional screening and monitoring.

The basic profile is also offered with some add-ons as an “Extended Health Risk Profile”. To keep charges to a minimum, requests for both the Health Risk Profile and the Extended Health Risk Profile are accepted on a non-urgent basis, but every attempt is made to have the results available within 12 working days.

Within the basic profile there are 5 panels of tests:

- Vitamins and related substances
- Elements
- Fatty acids
- Enzymes
- Bile acids, proteins and glycosylated haemoglobin (HbA1c)

The extended profile also includes:

B vitamins – thiamine (B1), riboflavin (B2), pyridoxine (B6), niacin (B3), and biotin (B7)

Vitamin D profile

Homocysteine

Urine iodine

The basic profile comes with an interpretive comment, based on an appraisal by the reporting biochemist of the significance of the results.

Vitamins and related substances

The vitamins measured are:

- Vitamin C (ascorbic acid),
- Vitamin A (retinol),
- Vitamin E (tocopherol)
- Beta-carotene, lycopene and lutein are also measured
- Vitamin D will be included if an Extended Health Risk Profile is requested.

‘Celebrating 25 years of Service to Doctors and Patients’

We regularly report deficiencies of vitamin C and vitamin E, reflecting their often poor dietary intake. In contrast, we find that high or toxic serum levels of vitamin A are more common than deficiency. This can be a reflection of excessive supplementation with vitamin A or of displacement of the vitamin from hepatocytes as a consequence of chronic ethanol consumption. Circulating levels of lycopene and carotene reflect the subject's dietary intake of these carotenoids, while serum lutein is the best marker of green vegetable consumption.

Elements

The elements measured in the Health Risk Profile are plasma chromium, copper, manganese, selenium and zinc, along with red cell magnesium as a marker of intracellular magnesium depletion.

Chromium is a co-factor in glucose tolerance factor and is hence thus essential for insulin action and glycaemic control.

Copper is a co-factor for cytochrome c oxidase, lysyl oxidase, dopamine B hydroxylase, tyrosinase, superoxide dismutase, and caeruloplasmin and its deficiency results in defective activity of these enzymes. Poor lysine oxidase activity, for example, results in defective X-linkage of collagen helices.

Manganese is a component of the antioxidant enzyme superoxide dismutase (SOD), which is present in all aerobic cells, where it is required for the de-toxification of oxygen metabolites. Manganese is also a co-factor for the enzymes hexokinase, pyruvate carboxylase, PEP carboxylase, glutamine synthetase, and xanthine oxidase (among others). It is required for the action of vitamin B1 (thiamine) and for normal brain function.

The biological functions of selenium in man 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 playing a role in mood control. There are at least 30 human selenoproteins, mainly function unknown.

There are now more than 300 known zinc-dependent enzymes and more than 2000 zinc-dependent transcription factors in humans. Before 1960 it was considered improbable that zinc deficiency could cause significant clinical problems, but now it is known that the effects of zinc deficiency include dermatitis and delayed wound healing, poor growth, poor development of cognitive function, poor immune function, chronic eye disease, and the multiple consequences of poor cell division and growth throughout the body.

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 perhaps the most common elemental deficiency seen in nutritional practice.

Fatty acids

The full Biolab fatty acid profile reports 32 fatty acids in the composition of erythrocyte membranes. In the Health Risk Profile a range of omega-6 and omega-3 essential fatty acids is measured. Either class of essential fatty acid may be deficient, although low intake of omega-3 fatty acids is specifically recognised as one of the major shortfalls in the typical UK diet.

Enzymes

The enzymes reported in the Health Risk Profile are as follows:

- Red cell glutathione peroxidase
- Plasma glutathione peroxidase
- Red cell superoxide dismutase
- Serum paraoxonase

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

On the one hand, low levels of glutathione peroxidase (GSHPx), superoxide dismutase (SOD) and paraoxonase represent a risk factor for the development of diseases associated with oxidative stress – such as cancer and heart disease. On the other hand, antioxidant enzymes are the first line of cellular defence against oxidative damage, to which the normal response is induction of these enzymes. So subjects with established vitamin E deficiency, for example, who are therefore in a state of oxidative stress, have elevated red cell SOD activity.

The Health Risk Profile includes alkaline phosphatase as a 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. 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.

Bile acids

While bile acids have no known function in the circulation, elevation of their serum concentrations is recognised as the most sensitive marker of hepato-biliary dysfunction, which can disrupt their flow into the gastro-intestinal tract and hence accumulation of bile acids in the peripheral circulation. Bile acids are seldom measured in clinical practice because this test is “too sensitive” and may show abnormalities before frank liver disease is apparent. Elevated serum bile acid levels may also result from increased bacterial de-conjugation of these substances in the small intestine, as occurs in small intestinal bacterial overgrowth (SIBO).

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 catabolism (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.

A significant rise in serum C-reactive protein (CRP) may be detected within 6 hours of an inflammatory stimulus. As such, CRP was for many years thought of as a sensitive indicator of inflammation, but more recent studies have shown that it can also initiate or exacerbate the development of inflammatory lesions; for example, it is now thought that CRP is not only a marker of atherosclerotic disease, but plays a role in its pathogenesis.

Haemoglobin A1c

Measurement of haemoglobin A_{1c} reflects the glucose concentration in the plasma over the preceding c.3 months. Glucose binds to the beta chain of 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 HbA_{1c} concentration is the best method of screening for diabetes mellitus.

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. Supplements can correct most deficiencies within 8 weeks, except in the elderly or those with chronic conditions.

Vitamin B3 (niacin) deficiency classically results in pellagra; this is a chronic wasting disease associated with diarrhoea resulting from inflammation of the intestinal mucous surfaces, a characteristic bilateral erythematous dermatitis, together with dementia, insomnia and apathy (*DDD – diarrhoea, dermatitis and dementia*). Less dramatic cases of niacin deficiency are found in people with gastro-intestinal disease and excess alcohol consumption, as well as in those on restrictive diets.

Symptoms of biotin deficiency (vitamin B7, coenzyme R, vitamin H) include reduced growth and impaired reproductive performance, as well as dermatitis. However, clinical signs alone are often insufficient to distinguish the symptoms caused by a deficiency of biotin from those caused by deficiency of zinc and hence biochemical means must thus be used to assess biotin status in cases of suspected deficiency. However, the diagnosis is seldom made due to the relative un-availability of this laboratory measurement.

Vitamin D profile

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 being 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 newly-appreciated 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 cause of cardiovascular disease and of impaired resistance to various types of infection.

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 be carried out in non-fasting subjects, since it is potentially produced in response to a dietary methionine load. This therefore requires a second venipuncture appointment, since the other Health Risk Profile analytes are best measured in fasting samples.

Iodine

Iodine (part of the Extended Health Risk Profile) is required for the synthesis of thyroid hormones. Iodine deficiency in the UK has re-emerged as a significant public health problem over the past few years.

Interpretation of results

The Biolab Health Risk Profile report contains an interpretive comment. This will be more useful if clinical data, drug and supplement history and a possible diagnosis are included on the request form. Reference intervals for all the analytes measured are shown on the report.

Patient preparation:

The patient should discontinue taking nutritional supplements for 48 hours before the collection of blood.

Specimen requirements

The following venoject tubes are needed for the Basic Health Risk Profile:

- 2 x EDTA tubes (lavender top)
- 1 x lithium heparin tube (green top)
- 1 x trace element free (dark blue top)
- 2 x serum separator tubes (red or gold top).

For the Extended Health Risk Profile, the following tubes are needed in addition:

- 1 x EDTA tubes (lavender top) – or postal homocysteine collection tube
- 1 x lithium heparin tube (green top)
- 3 x serum separator tube (red or gold top)
- Universal container for mid-stream urine (MSU)

The correct tubes are available from Biolab on request. If posted, blood samples must reach us within 24 hours.

Turn around time: 10 working days.