NUTRITIONAL HEALTH PANEL
Healthcare Professional Information

With a bounty of vitamins and supplements to choose from, the Nutritional Deficiencies Panel gives insight into how each patient metabolizes vitamins and minerals differently based on their genetic makeup.

Vitamins and minerals from the foods we eat help to nourish and heal our bodies. Deficiencies in these essential nutrients can contribute to many health ailments such as vision loss, digestive discomfort, osteoporosis, anemia, and depression.[1] Studies indicate that genetics play a large role in nutritional deficiencies.[2] The information provided in the comprehensive report allows for patients and providers to make informed dietary and supplement choices.

Clinical Utility:

Deficiencies in essential vitamins and minerals can oftentimes go unnoticed and have been associated with risks of many adverse health effects. Recent and reputable scientific research has shown that individuals' genes play a large role in these deficiencies.[2] The Nutritional Deficiencies Panel was assembled by a team of researchers who have identified the scientific studies regarding the specific genes that increase susceptibility to nutritional disorders and deficiencies involving Vitamin A, Vitamin B12, Vitamin D, Folate, and Iron.

What is Included in the Panel?

- **Vitamin A –** Vitamin A is a fat-soluble vitamin crucial for proper vision, immune response, and cellular differentiation.[3] Vitamin A is created from three natural vitamin A precursors called carotenoids essential compounds found mainly in plant-based foods.[4] The first step in the metabolic conversion of the three carotenoids is their cleavage by the enzyme beta, beta-carotene 15,15'-monooxygenase 1 (BCMO1) located in the small intestine.[5] Unfortunately, about 45 percent of the Western population can be classified as low beta-carotene converters.[6] A variant allele of the BCMO1 gene results in the reduction of the BCMO1's enzyme's catalytic activity by 48 percent, which can lead to a vitamin A deficient state.

- **Iron –** Iron is a common nutrient deficiency, resulting in anemia which can lead to fatigue, weakness, pale skin, and shortness of breath.[7] Several clinical biomarkers of iron – including serum ferritin concentrations, hemoglobin, and levels of iron-bound transferrin – are strongly heritable, indicating a role for genetics in iron deficiency.[7, 8] Scientists have found that a mutation in the gene coding for transmembrane protease serine 6 (TMPRSS6) is associated with several clinical indicators of anemia, including levels of serum iron, transferrin saturation, erythrocyte mean cell volume, and hemoglobin.[9,10]

Determine how common genetic mutations are impacting your patients and their quest for optimal nutrition.

CONSIDER TESTING INDIVIDUALS WITH THE FOLLOWING SYMPTOMS OR COMPLAINTS

- Anemia, as evidenced by: abnormalities in CBC labs (High or low MCV, low MCH, low HgB), mucosal or nailbed pallor
- Fatigue
- Hypersegmented neutrophils
- Frequent illness
- Night blindness
- Rickets or osteomalacia
- Atrophic glossitis
- Poor response to nutritional therapies
- Poor growth in children

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- **Vitamin D –** Vitamin D is produced by the body when skin is exposed to sunlight, and can also be found in fish, fish oils, egg yolks, fortified dairy and grain products. Vitamin D is essential for strong bones and deficiencies have been associated with rickets, diabetes, cardiovascular disease, and some cancers.[11] Up to half of all adults in the developed world suffer from vitamin D deficiency.[12] Researchers have identified variants in four genes that may play a role in vitamin D deficiency: GC, CYP2R1, VDR-Bsm1 and DHCR7/NADSYN1. Knowing the status of these gene variants could help healthcare providers identify a patient's risk for vitamin D deficiency.[13,14]

- **Vitamin B12 –** One of eight B vitamins, vitamin B12 plays a key role in brain and nervous system function, and is involved in the metabolism of every cell in the body; particularly in DNA synthesis and regulation.[15] A vitamin B12 deficiency, due to low consumption of animal-source foods and/or inadequate absorption, often associated with pernicious anemia, becomes increasingly common as people age.[15] Studies have also shown that individuals with reduced intake of vitamin B12 have elevated levels of homocysteine, an established predictor of cardiovascular disease.[16] Importantly, clinical research has identified multiple genetic mutations that affect vitamin B12 levels and the risk of deficiency.[16,17]

- **Folate –** The B vitamin is crucial to the maintenance of red blood cells, methylation of DNA, prevention of neural tube defects, and conversion of homocysteine to methionine.[15] Importantly, before it can play a role in maintaining and promoting health, folate must be converted into its active form through a series of enzymatic reactions. The methylenetetrahydrofolate reductase (MTHFR) enzyme is critical in this process. Scientific research has shown that common mutations that decrease MTHFR activity can lead to a reduction in the activated form of folate.[18, 19] Carriers of these mutations may be at an increased risk of certain cardiovascular diseases.[20]

How are Test Categories Selected?

There are numerous genetic variants that are found all throughout the genome and in many cases there is no physiological consequence for possessing one allele versus another. Consequently, before inclusion in the panel each gene was carefully researched by Kashi's PhD level scientists to assure that only the most informative genetic markers that have a well-established impact on health would be included in the test. Every gene that is included in the genetic panel has been carefully selected based on the following criteria:

1. Variants have been connected to the absorption, transport, activation or maintenance of key nutrients.
2. The effects of each genetic marker on nutritional status have been reported in several peer-reviewed journals.
3. The mutations included in the panel all impact nutrients that are involved in clinically relevant deficiencies.

Tying it all Together

The genetic markers included in the Nutritional Deficiencies Panel have been rigorously analyzed by our experienced researchers to deliver healthcare providers a deeper understanding of the genetic basis of their patients' nutritional status, to facilitate more timely and effective care.

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