Using Functional Medicine Blood Testing in a Naturopathic Medical Practice

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It is a very exciting time in health care for naturopathic doctors (NDs). In the last decade, medicine has been evolving at a feverish pace and never before has there been such a demand and public need for what naturopathic medicine can offer in the health care arena. As chronic illness continues to climb at record rates, the demands on the health care system are staggering and resulting in billions of dollars spent annually to treat chronic, preventable diseases such as cancer, heart disease, diabetes and auto-immune illness.

Sadly, primary treatment for many illnesses and diseases is only initiated once blatant symptomalogy occurs, missing the opportunity to treat the disease at its onset. As NDs, our objective is to treat the individual while identifying the root cause of disease and we are fortunate to live in an era where leaders in science & technology are putting forth cutting edge research, medical diagnostics and imaging. Biomarker diagnostics are powerful tools that allow the healthcare provider to tailor a treatment plan for each individual rather than following a 'one-size fits all', algorithmic-approach. Fortunately, as NDs we prioritize and value patient-focused, customized medicine while being granted the luxury to have a sufficient amount of time to spend in consultation with each patient. This privilege grants us the opportunity to actively listen and truly engage with our patients, which is vital in understanding and respecting their specific health goals.

While naturopathic medicine is deeply rooted in therapies that have withstood the test of time for decades, if not centuries – it is not to say that our medicine is out-dated by any means. Evolving science in the field of functional medicine, nutrigenomics, and epigenetics has brought forth new diagnostic 'tools' that further assist primary caregivers in helping to heal their patients using the principles and practice of naturopathic medicine. The purpose of this article to is provide a few examples of how innovations in functional blood laboratory testing can assist in improving the quality of information, treatment, and care we provide our patients with on a daily basis.

Micronutrient Testing

An overwhelming amount of scientific evidence confirms that various nutrient deficiencies are correlated with disease processes and the overall condition of one's health. Vitamin, mineral and antioxidant deficiencies have been shown to suppress immune function and contribute to chronic degenerative processes such as arthritis, cancer, Alzheimer's, cardiovascular disease and diabetes. This body of research has been reaffirmed by many leading publications, including the *Journal of the American Medical Association*,[1] and researchers continue to investigate the most effective and applicable way to measure deficiencies in humans. Traditionally, standard serum blood draws have been viewed as the gold standard for nutrient assessment. However, current medical literature demonstrates that standard serum blood draws may be somewhat limiting and not reflective of true cellular deficiencies. One example is a study performed on mothers with recurrent pregnancy loss (miscarriage, SAB) and/or birth defects. This study demonstrated adequate levels of maternal folate in serum, while intracellular RBC testing demonstrated consistent folate deficiencies throughout the study group.[2] Another study published in the American Journal of Clinical Nutrition, assessed the use of pyridoxine testing in patients with critical illness in order to understand the role of vitamin B6 with regards to inflammatory responses. This study found consistent deficiencies upon intracellular testing in patients who otherwise tested within normal limits with standard serum testing.[3] A third example cites a study testing for magnesium deficiencies and insulin resistance in those with metabolic syndrome. This study also provided evidence that demonstrates the superiority of intracellular vs. serum testing levels of nutrients.[4] It found that intracellular magnesium depletions in mononuclear cells is more common in people with metabolic syndrome. Static serum levels are not always representative indicators for assessing cell metabolism and utilization. Plasma concentrations of several trace elements and vitamins decrease because of the systemic inflammatory response and thus, low values do not necessarily indicate deficiency.[5] While the purpose of this article is not to promote any particular laboratories, there are select few that set themselves apart in the field of intracellular micronutrient testing. Micronutrient testing offers a unique means to empirically assess the intracellular requirements of micronutrients and their role in an individual's overall health and wellness. Cumulative research has provided evidence that levels of micronutrients such as; magnesium, selenium, vitamins B6, B5 and B12, vitamins C, E and A and zinc are more accurately measured when testing intracellular levels verses serum.

Single Nucleotide Polymorphism (SNP) testing

A fascinating, highly researched and growing area of medicine that has emerged in recent years is the field of genomics. Our DNA — the building blocks of life — once thought to be a static set of genetic material is now understood to be more influenced by our emotions, lifestyle, diet and environment than previously suggested. Intriguing work in the field of epigenetics has postulated that genes can act similarly to 'light switches', that can be switched on or off depending on nutritional, environmental, and emotional factors. Single nucleotide polymorphisms, or SNPs, are DNA sequence variations that occur when a single nucleotide (A,T,C,or G) in the genome sequence is altered. (i.e.: A**A**GGCTAA to A**T**GGCTAA.) Although more than 99% of human DNA sequences are the same, variations in DNA sequence can have a major impact on how humans respond to disease, and to environmental factors such as bacteria, viruses, toxins, drugs and other therapies.[6] This makes the understanding of SNPs not only highly beneficial in providing a preventative and treatment plan to our patients, but also provides valuable information for biomedical research - including the development of nutraceutical and pharmaceutical products, as well as medical diagnostics. Scientists believe SNP maps will help them identify the multiple genes associated with complex ailments such as cancer, diabetes, vascular disease, and some forms of mental illness. These associations are difficult to establish with conventional gene-hunting methods because a single altered gene may make only a small contribution to the disease. Many SNPs have no effect on cell function, but scientists believe others could predispose individuals to disease or influence their response to a specific treatment plan (i.e., nutritional or pharmacological).

In addition to pharmacogenomic, diagnostic and biomedical research implications, SNP maps are helping to identify thousands of additional markers in the genome, thus simplifying navigation of the much larger genome map generated by HGP (human genome project) researchers. SNPs are also evolutionarily stable — not changing much from generation to generation — making them easier to follow in population studies. Noted functional medicine expert, Dr. Jeff Bland, PhD, has stated that genotypic SNP testing "has a tremendous opportunity to create greater patient awareness and effectively tailored therapy." SNP testing is a powerful functional medicine blood test that provides a 'snapshot' of an individual's overall risk of specific illness (depending on SNPs tested) by looking at variants or single nucleotide polymorphisms. This is clinically applicable for the ND as this type of testing can help to illuminate part of a patient's medical destiny, therefore customizing a true prevention plan. Genova Diagnostics provides excellent panels in cardiology, immunity, neurology, endocrinology and detoxification pathways.

Telomere Testing

In 2009, the Nobel Prize in Physiology and Medicine was awarded to two brilliant scientists, Drs Elizabeth Blackburn and Jack Szostak, whose research linked telomere length to its role in various degenerative processes. Although their initial research was performed on plasmid vectors, the data is currently being extrapolated in human models. As a result of this groundbreaking research, telomere biology has recently emerged as an important player as it pertains to our understanding of aging and various disease processes.

Telomeres are sections of DNA at the end of each chromosome that serve as protective buffers keeping the ends of the chromosomes from becoming attached to each other or rearranging. In this way, telomeres prevent chromosomal fraying, much like the plastic coating at the end of shoelaces keeping the shoelace intact and prevent the loss of necessary information at the end of each chromosome.

Every time a cell replicates, its telomere become shorter, eventually causing cell death once the telomere attrition has reached a critical length. It is estimated that human telomeres lose about 100 base pairs from their telomeric DNA during each mitosis and disappear completely after approximately 125 mitotic divisions.[7]

Cells maintain the length of their telomeres with an enzyme called telomerase, that add genetic material to the ends of the DNA strand, thus lengthening the number of times it can replicate, and ultimately prolonging the life of the cell.[8] Telomerase is not active in most cells, but is active in stem cells, germ cells, hair follicles and most cancer cells.

Shorter telomeres imply a shorter life span for the cell and have been associated with metabolic abnormalities, obesity and several degenerative diseases including cancer, dementia and cardiovascular disease. In vitro studies have shown that telomeres are highly susceptible to oxidative stress, which will shorten telomere length and enhance cellular aging. Studies have found shorter telomeres to be associated with an increased incidence of developing various cancers, especially bladder, esophageal, gastric, head and neck, ovarian and renal.[9]

Risk factors associated with shortened telomeres have been well documented and minimizing associated risk factors that are linked to shortened telomere activity is recommended. Some preventative measures include:

- Reducing oxidative stress
- Correcting micronutrient deficiencies, in particular, vitamin C, D and E
- Changing sedentary lifestyle by increasing physical activity and avoiding weight gain/obesity
- Correcting insulin resistance

While more research is needed to further understand the role of telomeres and how we can apply this information to help optimize our patients' health and wellness, telomere testing has become a helpful biomarker in understanding in degenerative processes. As with all testing, proper interpretation of functional medicine data is essential to communicate and relay relevant information in an effective and judicious manner. Telomere testing is applicable clinically to NDs as this test provides a biomarker that can begin to quantify how preventative programs based on nutritional, environmental and lifestyle strategies improve the health and outcome of our patients.

Amino Acid Profile Testing

Amino acids, known as the "building blocks" of proteins, are found in every tissue of the body. They have a more diverse function than any other nutrient group and play a major role in nearly every chemical process that affects both physical and mental function. Gastrointestinal function, cellular energy production, detoxification, healthy vascular function, and muscle catabolism are dependent on their continuous supply of amino acids. Amino acids play a critical role in the formation of ligaments, tendons and bones as well as the formation of antibodies and the regulation of enzymes and blood transport proteins. As they are powerful cofactors necessary for neurotransmitter production, an accurate understanding of amino acids levels is necessary when treating any form of mental illness, specifically depression.[10]

Twenty different amino acids are used to synthesize proteins. The human body has all of the amino acids necessary to manufacture proteins, with the exception of ten amino acids, referred to as the "essential amino acids". These ten must be included in the diet or supplemented in order to be in adequate supply and require optimal digestion and absorption in order to attain sufficient levels. Failure to obtain enough of even one of these essential amino acids has serious health implications and can result in the degradation of muscle and other protein structures by the body in order to obtain the amino acid that is needed. Thus, a daily intake of adequate dietary protein is necessary to present tissue protein breakdown to supply the continuous amino acid needs.

The utilization of amino acids is highly tissue and time dependent. Plasma from blood drawn at any given moment will reflect the state of dynamic flux of amino acids leaving sites such as skeletal muscle and flowing into sites of utilization in the liver, brain and other tissues.[11] This gives the clinician an idea of the net effect of these two opposing forces controlling the levels of amino acids. Either a fasting plasma or whole blood amino acid profile will identify low amino acids and may be used to evaluate whether a patient is in need of an essential or conditionally essential amino acids. Fasting blood plasma avoids recent dietary influences and can provide a high level of reliability for showing changes in individual amino acid demands due to chronic stressors. Those who should be considered for amino acid testing are any patients with chronic illness (e.g., Multiple Sclerosis), malabsorption (e.g., celiac, IBD), detoxification disorders and those with cardiovascular complications (e.g., arrhythmia, hypertension and CVD).

Closing remarks

While standard blood testing is a critical part of understanding specific biochemical parameters, newly emerging functional medicine blood tests are bringing forth exciting information that can be applied to each individual patient. These tests help facilitate the development of a more refined, customized approach to aiding each patient along their health journey. It is my opinion that in order to provide our patients with the full spectrum of naturopathic medicine, we as NDs need to fully embrace the tools of our ancestors while also forging ahead and accessing the power and potential that modern science and technology brings to the table.

About the Author

Dr. John Dempster, ND is the medical director/founder of The Dempster Clinic – Center for Integrated Medicine, located in Yorkville, Toronto. He treats a variety of patients ranging from high performance individuals to those suffering from chronic illness. As an avid seeker in integrative and evidence-based medicine, he has furthered his studies by completing an advanced fellowship in functional, regenerative, and anti-aging medicine (FAAFM). In addition to his busy practice, he writes regularly for a number of publications and speaks to corporations on a variety of health & wellness topics. In addition, he is also featured frequently on national television and radio, and in newspapers and magazines. You can follow Dr. D on twitter @drjohndempster
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