InterClinical Laboratories
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Clinical Updates for the Healthcare Professional

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Essential Minerals and Mood Disorders

The prevalence of mood disorders in Australia and the rest of the western world is high. It is estimated that up to one third of the western worlds population will experience some form of mood disorder at least once in their lives.[1] Mood disorders include, but are not limited to, depression, bipolar affective disorder (manic depression), postpartum depression, seasonal affective disorder (SAD), and anxiety disorders.

In Australia, around one million adults and 100,000 young people live with depression each year. On average, one in five people will experience depression at some stage in their life.[2] Anxiety disorders are the most common mental disorders in Australia. Nearly one in ten people will experience some type of anxiety disorder in any one year and one in four people will experience an anxiety disorder at some stage of their lives.[3]

Mood disorders have many causes and contributing factors, and as depression and anxiety are symptoms of many other disorders, the first step in treatment is a thorough health check up in order to exclude any possible contributing medical conditions. It is important to note that many people will be able to recover from the disorder comparatively quickly, but others may have to live with and control a mood disorder long term. Physical causes of mood disorders that need to be considered include: nutritional deficiencies, hormonal disorders, toxic metal burdens, allergies, infections, medical conditions and drugs.

Of particular importance is the relationship between nutritional deficiencies and mood disorders. According to the Encyclopaedia of Natural Medicine, "A deficiency of any single nutrient can alter brain function and lead to depression, anxiety, and other mental disorders."[4] Essential nutrients are needed for both manufacture of neurotransmitters and energy production in the brain. Neurotransmitters, substances manufactured in the brain, carry impulses between nerve cells, affect brain function and play a role in the pathology of all types of mood disorders. The enzymes and co-enzymes needed to manufacture neurotransmitters are derived from vitamins, minerals and amino acids.The most common nutritional deficiencies seen in patients with mental disorders are of omega–3 fatty acids, B vitamins, minerals, and amino acids that are precursors to neurotransmitters.[5]

Minerals are of special importance because they serve as cofactors for both neurotransmitters and the active forms of vitamins required by neurotransmitters. For this reason, testing for mineral and trace element aberrations with InterClinical Laboratories Hair Tissue Mineral Analysis (HTMA) can play a critical role in establishing biochemical causes of mood disorders and determining treatment options in clinic.

What follows is a partial summary of some of the ways in which essential minerals are associated with changes in nervous system functioning and mood disorders.

Chromium

A major component of glucose tolerance factor (GTF), chromium is essential for regulating carbohydrate metabolism and blood sugar levels. Chromium augments the action of insulin and deficiency may cause hypoglycaemia or hyperglycaemia. Nervous system manifestations of hypoglycaemia include anxiety, confusion, inability to concentrate, depression, light-headedness, nervousness, mental disturbances, insomnia, anger and aggressive behaviour, moodiness, cognitive problems and lethargy.

In reactive-hypoglycaemia, a common disorder where recurrent episodes of symptomatic hypoglycaemia occur 2–4 hours after a meal, chromium supplementation prevents the excessive decline in blood-sugar levels and decreases the associated symptoms.[6]

In addition, chromium influences the sensitivity of certain receptors on brain cells that help control a person's mood. Studies have shown chromium supplementation may be of benefit for sufferers of dysthymia.[7]

Magnesium

Magnesium aids in transmission of nerve impulses and the synthesis, storage and release of several neurotransmitters. Magnesium deficiency interferes with transmission of nerve impulses and may cause agitation, anxiety, behavioural disturbances, confusion, depression, insomnia, irritability, premenstrual tension, lethargy, decreased attention span, personality changes, and hyper irritability and excitability.[8]

Participating as a cofactor in over 300 enzyme reactions in the body, magnesium has a multitude of different uses. Significantly for both cognitive function and management of mood, it is an essential cofactor of the enzyme delta-6-desaturase which converts vegetable-derived omega-3 fatty acids (alpha-linolenic acid) to the brain critical omega-3 fatty acid DHA (docosahexaenoic acid). DHA is essential for the rapid release of dopamine. If magnesium levels are low, DHA deficiency is very likely to exist. Individuals with major depression show marked depletion of omega-3 fatty acids in their red blood cell membranes.[9]

It is well-established that DHA deficiency states are positively linked with depression. A relative deficiency of essential fatty acids in cellular membranes alters cell membrane fluidity and significantly impairs cell membrane function. The brain contains the richest concentration of fatty acids in the body, and proper nerve cell function requires suitable membrane fluidity, so alterations in membrane fluidity greatly impact behaviour, mood and mental function. In the brain,

continued overleaf

fluidity of cell membranes influences neurotransmitter synthesis, signal transmission, uptake of serotonin and other neurotransmitters, and activity of monoamine oxidase (MAO)– the enzyme that breaks down serotonin and other monoamine neurotransmitters such as epinephrine, dopamine, and norepinephrine.[10]

Delta-6-desaturase also converts cis linoleic acid to gamma linolenic acid (GLA), an omega-6 fatty acid involved in the manufacture of prostaglandin E1 (PGE1). PGE1 increases the release and uptake of neurotransmitters such as serotonin in the brain, increasing feelings of wellbeing and calmness.

Zinc

Zinc is commonly found to be deficient in people with depression. Inadequate zinc may cause or be associated with moodiness, poor concentration, poor memory, mental fatigue, irritability, anger, lethargy and sleep changes.[11] A component of over 300 enzymes, zinc is an important cofactor in many biochemical reactions essential for normal neurological function and a cofactor for several neurotransmitters. With magnesium, zinc is an essential cofactor of the enzyme delta-6-desaturase for conversion of omega-3 fatty acids to DHA (see above).

Deficiency of zinc affects hormonal balance and function. Zinc is co-factor in thyroid hormone manufacture, conversion of T4 to T3 and thyroid receptor function. Thyroid disorders can disturb all body cells and functions, and subtle thyroid problems often go unnoticed. Psychological symptoms of hypothyroidism include mood changes, depression with weakness and fatigue, difficulty concentrating and forgetfulness.

Iron

Iron is necessary for oxygenation, energy production in the cerebral parenchyma, manufacture of neurotransmitters and synthesis of myelin. Up to 12% of women aged 12 - 49 years are iron deficient, with only 3% of men suffer from low iron levels. Research also shows that twice as many women as men are clinically depressed. This gender difference begins in adolescence and continues with age, becoming more pronounced among married women aged 25-45, with children. Furthermore, women of childbearing age experience more depression than during other times in their lives.[12] These correlations indicate the possible importance of iron in the aetiology of depression, as deficiency is known to cause symptoms of fatigue and depression.

Selenium

Selenium is another key nutrient required for functioning of thyroid hormones. A selenium dependent enzyme is involved in converting the hormone thyroxine (T4) to the active thyroid hormone (3,3'5-tri iodothyronine T3). Deficiency can also manifest in symptoms of hypothyroidism outlined above. Selenium supplementation has been shown to decrease anxiety and elevate mood (most noticeable in people who had lower dietary intake of selenium).[13]

Copper

Copper is required for healthy nerves, in particular for formation and maintenance of the myelin sheath which electrically insulates neurons and increases the speed of nerve impulse conduction. Copper containing enzymes (cuproenzymes) are also required for neurotransmitter synthesis and metabolism.

Due to these roles, either too much or too little copper can affect the nervous system. Depression is a symptom of both copper deficiency and toxicity. Signs of copper deficiency include decreased noradrenaline and dopamine secretion in the brain, which leads to neurological disorders.[14]

Copper toxicity is also associated with anxiety, aggression, agitation, irritability, nervousness, mood swings and post partum psychological problems.[15]

Calcium

Essential for maintenance of the nervous system, calcium is essential for proper nerve impulse transmission and neurotransmitter release. Individuals with depression are more likely than others to have disturbances in calcium metabolism.[16] Both deficiency and excess of calcium are associated with depression. Calcium has a calming effect, alleviates tension and irritability and promotes relaxation. Symptoms associated with calcium deficiency include agitation, delusions, hyperactivity, insomnia, and irritability.

Potassium

Electrolytes, including potassium, sodium and chloride, are essential mineral compounds that become electrically charged ions when dissolved in water. Normal physiological functions in the body depend on the strict regulation of electrolytes both inside and outside of cells.

Potassium plays a vital role in many functions of the nervous system including nerve transmission and complexing with phosphorus to deliver oxygen to the brain. Depletion is frequently associated with depression, tearfulness, weakness, and fatigue. Research has shown depressed patients are more likely than controls to have decreased intracellular potassium. Low potassium levels exacerbate irritability and anxiety. In several studies with people diagnosed with mild depression, increasing their intake of high potassium foods showed notable improvement in day to day mood.[17]

Toxic metals

Toxic metals are consistently identified as causative or contributing factors in neurological disorders. Toxic metals including mercury, cadmium, lead and tin affect chemical synaptic transmission and neurotransmitter function in the brain, causing behavioural and mood changes - and disorders of the neurological system such as depression.[18] Toxic metals also block the absorption, metabolism, storage and actions of essential nutrients in the body, resulting in nutrient deficiencies. Deficiencies of essential minerals results in increased accumulation of toxic metals and subsequent neurotransmitter imbalance due to inadequate nutrients for neurotransmitter synthesis. Conversely, being replete in essential nutrients assists in blocking toxic metals and preventing this cycle of damage.

Every mineral has dynamic relationships with other minerals, aiding in excretion and absorption of other elements. This includes essential minerals as well as toxic heavy metals, so excessive supplementation with single nutrients can cause deficiencies of other nutrients. For example, supplementation with high doses of zinc over extended time can deplete copper, resulting in disruption of catecholamine neurotransmitter production and copper deficiency symptoms.

Appropriate nutritional intake through diet and supplementation is an important component in treatment and management of mood disorders. Undertaking an InterClinical Laboratories HTMA is a useful way to rule out heavy metal toxicity or essential element deficiencies as the cause of depression or other mood alterations. Diet, supplementation, medication and lifestyle factors create changes in the body's levels of minerals and trace elements. Monitoring changes that occur due to these measures is also necessary.

Lyndal Brodie BA Dip Nut

Use of Hair Mineral Analysis for Detecting Trace Element Deficiency in Chronic Gastrointestinal Disease

This paper explored the use of hair tissue mineral analysis (HTMA) studies conducted at TEI on the trace element status of children with chronic gastrointestinal (G.I.) disease. Gastrointestinal disease contributes to the risk of mineral deficiencies due to impaired absorption and G.I. losses. Blood and HTMA studies were performed to evaluate mineral status of patients with G.I. disease. The results revealed that almost all patients had mineral deficiency. Trace elements found deficient in the blood or hair included zinc, selenium and copper. Hair zinc levels were found to be

significantly lower in groups receiving parenteral nutritional support and hair selenium levels were significantly associated with clinical symptoms of selenium deficiency. Results suggested that patients with G.I. disease should receive adequate zinc and selenium replacement treated with long-term parenteral nutrition and that hair mineral analysis is a useful and complementary tool for the determination of trace elements status.

Trace Elements Deficiency and the Diagnostic Usefulness of Hair Mineral Analysis in Children with Chronic Gastrointestinal Disease. Hong, J, et al. Korean J. Ped. Gastroenterol. Nutr. 11, 2008.

Hair Mineral Status and Variations in Body Mass Index

Investigations of hair calcium, magnesium, sodium, potassium, iron, copper and zinc were conducted on four groups of adult females totaling three hundred ninety two individuals ranging in age from twenty to fifty years with different body mass index. The women were grouped according to their body mass index (BMI) consisting of slim, normal, obese and morbidly obese groups. Significant differences were noted between the slim and morbidly obese groups in their concentrations of hair zinc levels as well as their calcium, magnesium, sodium, potassium, and copper levels. Also the groups with the highest BMI had the highest ratio of K/Na, but the lowest ratios for fe/Cu and Zn/Cu compared to the low BMI group. The study suggests that hair mineral concentrations may be correlated with adult BMI.

Concentrations of Calcium, Copper, Iron, Magnesium, Potassium, Sodium and Zinc in Adult Female Hair with Different Body Mass Indexes in Taiwan. Wang, CT, et al. Clin. Chem. Lab. Med. 43,4, 2005.

Reducing Dietary Sodium, The Case for Caution

Alderman asks the question, "Do observational studies by repeated, robust and consistently positive findings justify a public health recommendation." Further he sites that interventions based upon observational data is often flawed and uses the example of the 1980 National Dietary Guidelines that recommended the population-wide reduction of total fat intake which may have contributed to the unanticipated epidemic of obesity and diabetes today. The 2000 meeting of the committee withdrew these earlier guidelines. He sites thirteen observational studies that reviewed the relationship between sodium consumption and clinical outcomes. In almost half of the studies there was no association between salt intake and clinical outcomes. In four studies, sodium intake was found to be inversely associated with cardiovascular disease events. Higher salt intake was associated with worse outcomes in some societies with high salt intake, but lower salt intake was associated with worse outcomes in societies with moderate salt intake. Studies have established that reduction of salt intake sufficient to lower blood pressure also increases sympathetic activity, decreases insulin sensitivity, activates rennin angiotensin system and stimulates aldosterone secretion. Some studies show that overzealous sodium restriction may be harmful for those patients with heart failure. Alderman, states that government sanctions for the reduction of salt intake after looking at the facts is generally acknowledged to be just an opinion or common practice.

Reducing Dietary Sodium, The Case for Caution. Alderman, MH. JAMA, 303,5, 2010

Comment: In TEI Newsletter, 5,1, 1991 Sodium-Decrease Or Increase Your Intake?, Dr. Watts discusses the impact of sodium intake based upon individual metabolic characteristics. Some individuals who are considered sodium sensitive or who retain sodium readily would in fact benefit from sodium restriction. This is only a small percent of the population, approximately ten percent. However the majority of the population who are sodium insensitive could have a markedly negative effect from sodium restriction in their diet. In effect, a government recommendation for the universal reduction in salt intake would negatively impact the majority of the American population.

(TEI newsletter available online at url:
www.traceelements.com/News%20Jan-Feb%2091c.pdf)

Psoriasis

Many people who are afflicted with, or predisposed to the skin condition psoriasis should be aware of the drugs that may contribute to it's further development. These include, tetracyclines, beta-blockers, lithium, synthetic antimalarial agents, and inhibitors of tumour necrosis factor.

Psoriasis. Salem, CB, et al. N.E.J.M. 361,17, 2009.

How Cancer Wreaks Havoc on Bone

Destruction of bone by malignant tumours can be speeded up by an insulin-like hormone in the body. The hormone is known as relaxin. High levels have been linked to a number of cancers such as endometrial and prostate cancer, breast, thyroid and myeloma. Researchers found that relaxin stimulates osteoclastic cells triggering runaway bone resorption.

How Cancer Wreaks Havoc on Bone. Margottini, L. ScienceNOW. Feb. 2010.

Comment: It is interesting that oestrogen enhances the production of relaxin during pregnancy, yet this study did not tie in the relationship of relaxin to the oestrogen hormone.

Cholesterol Drug Lowers LDL–C Levels But Again Fails to Show Clinical Benefit

Ezetimibe, a commonly prescribed cholesterol drug that inhibits intestinal absorption of cholesterol does reduce LDL cholesterol. However, there is no evidence that this lowering of LDL to target levels by the drug has any clinical or meaningful benefit, such as the reduction of myocardial infarct, stroke or death. Why doctors are continuing to prescribe the drug is unknown except that they are probably in a "prescribing rut" and fail to use more proven and effective measures such as niacin. The article states that many doctors focus on reaching target goals for LDL levels rather than treating the patient.

Cholesterol Drug Lowers LDL-C Levels But Again Fails to Show Clinical Benefit Mitka, M. JAMA, 303,3, 2010.

The Metabolic Syndrome

The author sites that prevalence of metabolic syndrome can be affected by shift work. Those working night or swing shifts exposed to bright lights at night and sleep deprivation can have an increase in adiposity. Adipose tissue is affected by "clock genes" which affect their level of expression and genetic variants associated with the metabolic syndrome.

The Metabolic Syndrome. Eckel, RH, et al. The Lancet. 75, 2010.

Lung Cancer and Hormone Replacement Therapy

A post hoc analysis of the Women's Health Initiative trial highlighted lung cancer as a new harmful effect of hormone therapy, increasing the risk profile of hormone therapy among post-menopausal women. Grant describes several mechanisms that may contribute to this increase. Hormone therapy lowers zinc and increases copper concentrations. This produces an increase in vascular over-reactivity, impairs immunity and reduces the clearance of other carcinogens by the liver. The reduction in zinc concentrations allows toxic metal accumulation, such as cadmium.

Lung Cancer and Hormone Replacement Therapy. Canonico, M, et al. Grant, ECG. Correspondence. The Lancet 375, 2010.

Differences in Metal and Metalloid in the Hair of Normo– and Hypertensive Postmenopausal Women.

Hair samples were analysed in a normal and hypertensive group. Elevated cadmium, manganese and sodium were significantly higher in the hypertensive group. The study concluded that HTMA results indicate that scalp hair concentrations of certain elements may be used as biomarkers for hypertension in postmenopausal women.

Differences in Metal and Metalloid in the Hair of Normo- and Hypertensive Postmenopausal Women. Gonzalez-Munoz, MJ, et.al. Hypertens. Res. Jan. 2010.

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Melbourne	**August 7 & 8**	**Park View Hotel**

SEMINAR TIMES

SAT: 12.30pm – 5.15pm **(Primary Course–Day 1)**
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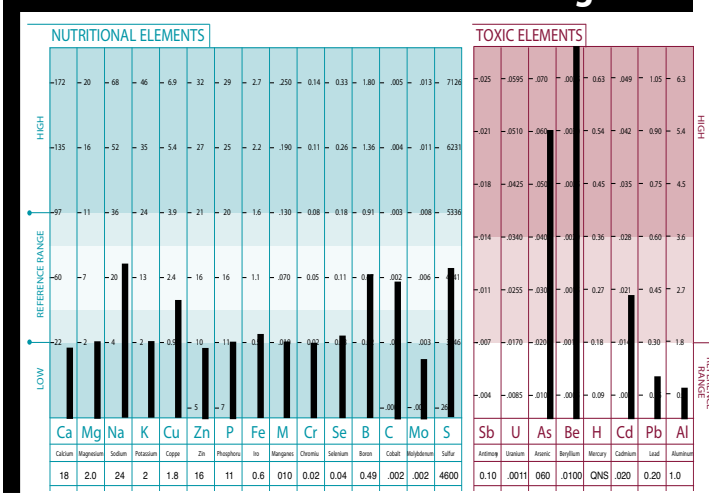

Hair Tissue Mineral Analysis (HTMA)

HTMA is a non invasive analytical test that measures the mineral composition of hair. Tissue analysis is a valuable screening tool used by doctors, naturopaths and nuritional therapists. It provides clinical information often not revealed through standard blood and urine testing.

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