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Hair Tissue Mineral Analysis

Nutritional Products

Practitioner Education

Research and Development

HTMA and Adrenal Support

By Lyndal Brodie, BA, DipNut

Introduction: HTMA and Metabolic Function

In the assessment of body tissues, hair is widely recognised as an excellent tool for assessing the nutritional status of an individual, due to its ability to reveal levels of nutritional and toxic metals in the body. Hair Tissue Mineral Analysis (HTMA) is also a useful resource for assessing metabolism and endocrine function of the body, as the mineral patterns found in the hair reflect the internal metabolic environments.

Metabolism is a term used to describe nutrient utilisation or efficiency on a cellular level resulting in energy production and maintenance. The nervous system and endocrine system control metabolism of nutrients.

The autonomic nervous system and endocrine system are interconnected and coordinated as the neuroendocrine system, which controls the body's homeostatic mechanisms and coordinates all body systems. The hypothalamus serves as the link between the nervous system and the endocrine glands system. It relays information to the pituitary gland, which in turn regulates the amount of hormone production among several endocrine glands. In general, hormones regulate metabolic activity by speeding it up or slowing it down.

Like minerals, the endocrine glands have antagonistic and synergistic relationships. A decrease in the activity of a gland will in turn allow increased expression of an opposing gland, or will alter tissue sensitivity to its hormone. Alterations in endocrine activity influence metabolism, absorption, retention and excretion of minerals and show distinct effects on the tissue mineral patterns found in the hair.

To better understand the neuroendocrine system it can be categorised according to stimulating or sedating effects. In healthy people the glands continue to vacillate depending on circumstance.

The autonomic nervous system has two branches – the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). In general the SNS, which stimulates metabolic processes, corresponds to a group of endocrine glands that are considered stimulating. Fast metabolisers are usually dominant in sympathetic glandular and neurological activity. The PNS and related endocrines are considered sedative to metabolic processes. The slow metaboliser is dominant in parasympathetic or anabolic glandular and nervous system activity.

Depending on whether the patient is sympathetic or parasympathetic dominant, stress can cause either overactivity or underactivity of the adrenal gland, leading to endocrine disorders and immune dysfunction. This imbalance increases the patient's nutritional needs in specific ways, depending on their individual metabolism.

Endocrine Function: The Adrenal Glands

The adrenal glands manufacture and secrete a number of hormones that are the body's main coping mechanism in dealing with stress. These include adrenalin (epinephrine), noradrenalin (norepinephrine), cortisol and cortisone. The adrenal glands also produce aldosterone, oestrogens, testosterone, progesterone, pregnenolone and DHEA. Small structures located above each kidney, the adrenals are comprised of an internal part (medulla) and outer part (cortex).

The hypothalamic-pituitary-adrenal axis (HPA axis) consists of the hypothalamus, the pituitary gland and the adrenal glands – and their interrelationships. This group of organs works together, to control major physiological functions. The HPA axis is responsible for moderating responses to stress and regulates metabolism, digestion, the immune system and mood.

Stress and the Adrenal Glands

The adrenal cortex and medulla work together to handle stress, however, the adrenal cortex responds primarily to pituitary stimulation, whereas the medulla responds to electrical messages sent directly from the nervous system.

The adrenal medulla secretes adrenaline in response to acute stress and prepares the body for "fight or flight". Adrenal hormones are released in potentially life threatening situations and directly affect heart rate, blood pressure and supply of blood to major organs such as the brain, heart and skeletal muscles.

The adrenal cortex secretes steroid hormones including cortisol, to help the body adapt to chronic stress. In response to stress, the pituitary gland increases its production of adrenocorticotropic hormone, (ACTH), which in turn stimulates the release of cortisol (and cortisone).

Cortisol is responsible for increasing glucose synthesis in the liver for energy, breakdown of protein, and inhibiting glucose uptake and utilisation into cells resulting in mild insulin resistance. Excess cortisol as a consequence of increased stress results in suppression of inflammation and immune function and increases appetite, energy intake, and central weight gain. It suppresses bone formation, causes loss of muscle mass and weakness, changes in mood and sleep, and increases blood pressure. Protracted activation of the stress response may lead to adaptation or adrenal exhaustion in which cortisol levels may drop to insufficient levels causing fatigue or illness.[1]

Hans Selye's research provides the classic model for adaptation to stress. He observed that given any source of external biological stress, an organism would respond with a predictable biological pattern in an attempt to restore its internal homeostasis. He termed this the General Adaptation Syndrome (GAS) or Biological Stress Syndrome, and divided the response into four categories:

1) the "alarm reaction" characterised by an immediate activation of the nervous system and adrenal glands;
2) a "resistance phase" characterised by hypothalamic-pituitary-adrenal (HPA) axis activation;
3) a stage of adrenal hypertrophy, gastrointestinal ulceration, along with thymic and lymphoid atrophy; and
4) an exhaustion phase which may culminate with death.[2]

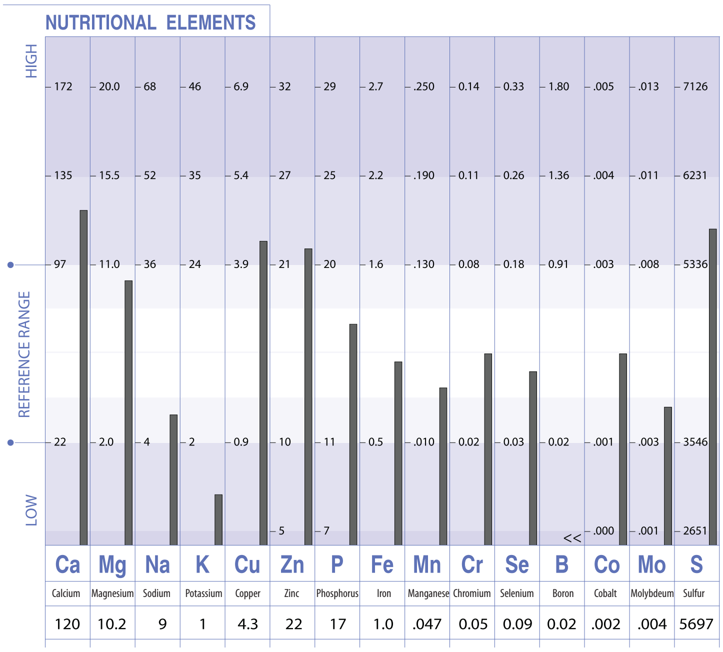
Chronic activation of the stress system, due to continuing or intense exposure to stressors, combined with the inadequacy to cope, or perceived loss of controllability, will be therefore characterized by the persistent activation of the HPA system and elevation of circulating cortisol.[3]

Why do we need to support the adrenals?

According to Seyle, the difference between whether or not stress is harmful depends upon the "strength of the system". This is related not only to adrenal reserve, but also to the closely related issue of dietary intake.[4]

Continued on next page

HTMA studies reveal the majority of the population, approximately 80%, are slow metaboliser.[5] In the slow metabolic type, adrenal activity is generally slowed as a result of relatively overactive SNS. The typical mineral pattern of slow metabolisers shows increased retention of sedative minerals (calcium, magnesium, copper) relative to stimulatory (sodium and potassium).



Typical mineral profile of a Patient complaining of fatigue (slow metaboliser).

The mineral pattern reflected in the above test results is indicative of a slow metabolic (Type #1) pattern. Low tissue sodium and potassium relative to calcium and magnesium is associated with adrenal insufficiency.

High calcium to potassium is associated with an underactive thyroid. Fatigue is often a common complaint associated with low thyroid function. NB: Minimal levels of Boron may be a consequence of low levels of electrolyte minerals.

Within the slow and fast metabolic subtypes, research by Dr David Watts has identified eight metabolic subtypes. The individual's signs and symptoms are largely controlled by nervous and endocrine activity, and these symptoms will change according to the stage of stress response.

Reduced adrenal function may occur in slow and fast metabolisers.

The increased production of adrenal hormones is responsible for most of the symptoms associated with stress. It is also why stress leads to nutritional deficiencies. Increased adrenalin production results in the body stepping up its metabolism of proteins, fats and carbohydrates to promptly produce energy for the body to use. This response causes the body to excrete amino acids, potassium and phosphorous, to deplete magnesium stored in muscle tissue and to store less calcium. In addition, the body does not absorb ingested nutrients well when under stress.[6]

Adrenal overactivity is associated with symptoms such as anxiety, palpitations, sweating and high blood pressure. Overactivity can become underactivity if the adrenal glands reach exhaustion. Over-stimulation of your adrenals can be caused either by a very intense single stress, or by chronic or repeated stresses that have a cumulative effect. Adrenal underactivity is associated with conditions such as sodium and potassium deficiency, low blood pressure, poor circulation, weakness, fatigue and coldness.

"Adrenal fatigue" is a label sometimes applied to a collection of non-specific medically unexplained symptoms, but it is not a medical condition recognised by the mainstream medical community. The adrenal glands are claimed to be exhausted and unable to produce adequate quantities of hormones, primarily cortisol. The term is distinct from clinically defined adrenal dysfunction disorders such as adrenal insufficiency or Addison's disease.[7]

Addison's disease is a rare condition that may develop if the adrenal cortex is seriously underactive. Symptoms include fatigue, weakness, loss of appetite, dizziness or fainting, weight loss, low blood pressure, nausea, diarrhoea, depression, craving for salty foods, moodiness, a decrease in the amount of body hair, constantly feeling cold, discolouration/darkening of the skin and inability to cope with stress.[6,8]

Aldosterone deficiency in particular causes the body to excrete large amounts of sodium and retain potassium, leading to low levels of sodium and high levels of potassium in the blood. The kidneys are not able to concentrate urine, so when a person with Addison's disease drinks too much water or loses too much sodium, the level of sodium in the blood falls. People with this condition crave and eat copious amounts of salt (unless they are taking adrenal hormones). In addition, slow metabolisers generally have excesses of minerals that are sodium protective – calcium and magnesium, which compounds the problem.[9] Inability to concentrate urine ultimately causes excessive urination and dehydration. Severe dehydration and a low sodium level reduce blood volume and can culminate in shock.

Suboptimal adrenal function, referred to as mild adrenal insufficiency, hypoadrenal or adrenal fatigue is extremely common.[10] This syndrome is distinct from adrenal burnout, which results in symptoms that are similar but more severe and take longer to correct, and Addison's disease, a total shutdown of the adrenal glands. Non-specific symptoms, commonly seen in marginally deficient patients, include poor mental clarity, decreased sexual function, decreased libido, and just not "feeling right".[8] Reduced adrenal function may also be indicated by weakness, lethargy, dizziness, headaches, memory problems, food cravings, allergies and blood sugar disorders.[6]

Adrenal fatigue may affect anyone who experiences frequent, persistent or severe mental, emotional or physical stress. It can also be an important contributing factor in health conditions ranging from allergies to obesity. During adrenal fatigue the adrenal glands function, but not well enough to maintain optimal homeostasis because their output of regulatory hormones has been diminished - usually by over-stimulation.[11]

Anyone can experience adrenal fatigue at some time in his or her life. However, there are factors that increase susceptibility to adrenal fatigue. These include certain lifestyles (poor diet, substance abuse, lack of sleep or relaxation), chronic illness or repeated infections eg bronchitis or maternal adrenal fatigue during gestation. Various biological stressors from toxins to allergies can also suppress adrenal function.

The Thyroid-Adrenal Connection

Nutrients that support the thyroid also need to be considered, as thyroid hormone regulates mitochondrial function. Low thyroid hormone activity results in poor mitochondrial energy production. The adrenal and thyroid gland are closely connected in the response to stress. Cortisol acts on the thyroid by facilitating both the release of TSH from the pituitary and the conversion of T4 to T3 (metabolically active form) and allowing T3 cell receptors to receive T3 more readily. Cortisol can also inhibit conversion of T4 to T3, resulting in stress-induced decreases T3 levels.[12]

Acute and repeated stress can alter thyroid hormone secretion. Low cortisol adrenal fatigue places the body into a protective state in which thyroid function is decreased to reduce the metabolic rate, to cope with the low cortisol production.[13]

Research from HTMA studies shows a synergistic relationship between the adrenal and thyroid glands. When thyroid function is decreased, adrenal function typically follows suit. On the contrary, when thyroid function is elevated, adrenal activity is also increased. Often, thyroid support alone does not aid in improving metabolic activity unless adrenal support is initiated.[14]

A number of cases have been reported of individuals having signs of hypothyroidism with elevated TSH, and low free thyroxine concentration in conjunction with adrenal insufficiency. Adrenal hormone support resulted in normalization of thyroid function without any type of thyroid support.[15]

Supporting Adrenal Function with Synergistic Nutrients and Botanical Extracts

The adrenals may be affected by appropriate nutritional therapy, thereby reversing or preventing further metabolic disturbances produced by their relative dominance and/or inhibitory effects.

Human and animal shows a variety of nutritional and botanical substances may support a sustained adaptive response to stress and reduce some of the systemic effects of stress.

Vitamins and minerals are essential cofactors in the production of adrenal hormones and herbal medicines have been used historically to modulate adrenal functions. Adrenal adaptogens balance abnormal adrenal hormone output and are used to increase low levels of hormones or decrease elevated hormone levels.

Important functions of nutrients and botanicals that support the adrenal response include:

Vitamin B1

Vitamin B1 (thiamin) is an essential cofactor in the production of adrenal hormones. It is essential for energy production in the brain, so mental efficiency and a feeling of well-being are dependant on this nutrient. B1 has a crucial role in metabolism of glucose, so even a mild deficiency can result in apathy.[16,17,18,19] Experimental and clinical results have shown thiamin to be effective in protecting the adrenal gland from functional exhaustion secondary to surgery. Thiamine injections (120 mg/day), commencing several days prior to surgery and within two hours immediately prior to surgery, reduced the cortisol reaction, both prior to and at the height of the surgery. Post-operation, continued administration of thiamin prevented the normal post-surgery reduction in blood cortisol levels.[20]

Vitamin B5

Known as the "antistress" vitamin, B5 (pantothenic acid) plays an important role in adrenal function and cellular metabolism. Vitamin B5 as coenzyme A (CoA) is needed for proper adrenal cortex function. It supports the adrenal glands in manufacturing of cortisone (pre-cursor of cortisol) and other adrenal hormones that counteract the stress response and enhance metabolism. In addition, CoA is needed to convert choline into acetylcholine, an important neurotransmitter involved with neuromuscular reactions, attention, memory and learning.[18,21] There is correlation between pantothenic acid tissue levels and function of the adrenal gland.[19] Research shows functioning of the adrenal cortex function is impaired when there is a deficiency of vitamin B5 derivatives and metabolises.[22]

Vitamin B6

Also an essential cofactor in the production of adrenal hormones, Vitamin B6 has a critical role in brain function. It is involved in the manufacture of all amino acid neurotransmitters (e.g. serotonin, dopamine, melatonin, epinephrine, norepinephrine, GABA etc.)[18,23] so supports optimum nervous system function and influences cognitive performance. Therapeutic use of pyridoxine includes anxiety and stress. Vitamin B6 may also increase the intracellular concentration of zinc (see below) and is synergistic with zinc in protein metabolism.[18]

Vitamin C

Vitamin C (ascorbate) is an essential cofactor in the production of almost all of the hormones produced by the adrenal glands. The adrenal gland is one of the organs with the highest Vitamin C concentration in the body and it is depleted from the adrenal cortex upon high cortisol secretion. Both the adrenal cortex and medulla accumulate it at high levels. It is required for the biosynthesis of noradrenalin from dopamine and biosyntheses of steroid hormones.[25] It is also involved in neurotransmitter synthesis, importantly the hydroxylation of tryptophan to produce serotonin.[23]

Research also indicated Vitamin C may reduce oxidative stress caused by sub-optimal thyroid production.[26]

Sodium and Potassium

Synergistic support minerals, sodium can affect potassium balance and potassium in turn effects sodium regulation by the kidneys. Sodium and potassium are essential cofactors in the production of adrenal hormones, and adrenal hormones affect the kidney's regulation of the electrolyte minerals. Plasma and tissue levels need to be maintained very closely. Aldosterone is the major hormone affecting sodium retention and adrenalin is a principle hormone that affects the cellular uptake of potassium.[5]

Zinc

Marginal zinc deficiency is common, as zinc is depleted by stress. Many factors including illness, increased thyroid activity, hyperadrenal function, medications and toxic metal accumulation can all contribute to zinc deficiency.[5] Serum levels of zinc are reduced under cortisol secretion.[27]

Zinc deficiency leads to diminished immunity and increases in opportunistic infections. Research clearly indicates episodes of acute stress of will cause, at the very least, a temporary decrease in functioning of the immune system, while chronic stress will result in continued decline in immune system function.[22] Supplementation with zinc leads to improved immune function.[23]

Zinc is also essential for healthy genetic expression and homeostasis of thyroid hormone. It is as a cofactor in synthesis of thyrotropin releasing hormone (TRH) and modulates conversion of T4 to T3.

Glycyrrhiza glabra (Liquorice)

Liquorice is the most highly regarded herb used to treat conditions associated with diminished adrenal function. It is known to have several actions including adrenocorticoid activity.

Liquorice contains triterpenes, constituents that have a similar structure to adrenal hormones and help to support and restore normal adrenal function, particularly in times of stress, overwork, exhaustion or 'burnout'. Liquorice has an ACTH-like action on the adrenal cortex and anti-inflammatory effects similar to hydrocortisone. It mimics adrenal corticosteroid activity - steroidal compounds glycyrrhizic acid and carboxenolone bind at catalytic sites in a similar way to cortisone. The active constituents bind to both mineral corticoid and glucocorticoid receptors. These constituents are also known to increase the half life of circulating cortisol in the body. Components of liquorice can also counteract some of the adverse immunosuppressive effects of excess levels of cortisol.

Available scientific evidence indicates Glycyrrhiza may be the most appropriate in cases of inadequate levels of cortisol being produced, correlating best with Seyles' fourth stage of "exhaustion".[22]

Panax ginseng (Ginseng)

Adaptogen Panax ginseng improves the action of the adrenal cortex in secreting stress hormones.[32] Ginseng has demonstrated ability effects in human clinical studies on improving physical performance, cognitive function, alertness, mood, and metabolism.[33,34] Countless animal experiments show ginseng increases resistance to a wide variety of physical, chemical and biological stressors and countered effects of ageing.[36]

Ginseng is thought to profoundly influence the HPA axis. It appears to act mainly on the hypothalamus and has a sparing action on the adrenal cortex, mediated through the anterior pituitary and ACTH release.

It is thought ginseng supports the efficiency of adrenal cortex in phase 1 (alarm reaction) of the GAS by enabling a stronger, quicker response and more effective feedback control, so that when stress decreases, glucocorticoid levels fall back to normal more rapidly. In phase 2 of the GAS ("resistance phase"), during prolonged stress, cortisol production is reduced by ginseng (sparing effect) and adrenal capacity is increased (trophic effect). Ginseng also raises plasma ACTH and cortisone in a non-stressed state when administered by injection.[36]

Regarding the application of ginseng in nutritional formulae: In a double-blind study, a multivitamin preparation containing ginseng root extract improved subjective parameters in a population exposed to the stress of high physical and mental activity. This suggests an adaptogenic or anti-stress ability of this combination in humans.[37]

Zingiber officinale (Ginger)

Ginger root is an ancillary adrenal adaptogen that helps modulate cortisol levels, increase energy, and stimulate digestive enzyme secretions for proteins and fatty acids. It also stimulates circulation and metabolism.[40]

Reference available http://www.interclinical.com.au/

InterClinical Laboratories Trace Nutrients range incudes Aden Complex, a special adrenal support formula designed to enhance and help support normal adrenal function. Aden Complex contains the botanical extracts and synergistic nutrients discussed above; Vitamins B1, B5, B6, C; sodium and potassium; zinc; liquorice; ginseng and ginger.

For more information please contact
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SEMINAR OUTLINE

HTMA Primary Course (Day 1)

Introduction to HTMA in Clinical Practice

■ Importance of mineral ratios ■ Mineral synergists and antagonists ■ Metabolic typing and endocrine relationships ■ Nutrient and mineral toxic ratios ■ Vitamin and mineral relationships ■ Heavy metals and chelation ■ HTMA sampling, procedures and laboratory overview ■ Report interpretation ■ HTMA case studies with practical applications in clinical practice

HTMA Advanced Course (Day 2)

Minerals and mental health

■ The role of nutritional elements in the nervous system ■ Implications of nutrient imbalances and effects of toxic metals on the nervous system ■ Minerals and the neuro-endocrine system ■ Hormonal factors affecting the nervous system ■ Mood disorders and endocrine imbalances: the thyroid adrenal connection ■ Effects of hormones on mood ■ Women's health: hormonal imbalance, depression and anxiety ■ HTMA case studies and mental health disorders ■ Nutritional support for mood disorders

SPECIAL PRICE FOR EARLY BIRD BOOKINGS!

VENUES

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Sydney	July 3 & 4	Vibe Hotel
Melbourne	August 7 & 8	Park View Hotel

SEMINAR TIMES

SAT: 12.30pm – 5.15pm (Primary Course–Day 1)
SUN: 9.00am – 5.15pm (Advanced Course–Day 2)

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Adrenal support

Aden Complex

Formulated by Dr David L. Watts for professional recommendation.

Research shows a variety of nutritional and botanical substances may support a sustained adaptive response to stress and reduce some of the systemic effects of stress.

Vitamins and minerals are essential cofactors in the production of adrenal hormones and herbal medicines have been used historically to modulate adrenal functions. Adrenal adaptogens balance abnormal adrenal hormone output and are used to increase low levels of hormones or decrease elevated hormone levels.

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REFERENCES

1. Gupta S et al, 2007. Inclusion of the glucocorticoid receptor in a hypothalamic pituitary adrenal axis model reveals bistability. Theor Biol Med Model 14;4:8.

2. Selye HA. The Stress of Life. New York, NY:McGraw-Hill; 1976. (cited in Kelly GS, 1999. Nutritional and Botanical Interventions to Assist with the Adaptation to Stress. Alternative Medicine Review 4(4): 249–265.

3. Tafet GE et al, 2001. Correlation between cortisol level and serotonin uptake in patients with chronic stress and depression. Cognitive, Affective & Behavioral Neuroscience 1 (4), 388-393.

4. Ghen MJ & Moore CB, 2010. Implications of adrenal insufficiency. Article available online from URL: <http://www.mitchellghen.com>.

5. Watts DL, 2006. Trace Elements and Other Essential Nutrients. 5th ed. Self Published.

6. Balch PA and Balch JF, 2000. Prescription for Nutritional Healing. 3rd ed. Avwery, New York.

7. Nippoldt TB. "Adrenal fatigue: What causes it?" Mayo Foundation for Medical Education and Research Article available online from URL. <http://www.mayoclinic.com/health/adrenal-fatigue/AN01583>.

8. Ghen MJ & Moore CB, 2010. Implications of adrenal insufficiency. Article available online from URL: <http://www.mitchellghen.com>.

9. Watts DL, 1991. Sodium – decrease or increase your intake? Trace Elements Inc. Newsletter 5(1).

10. Graham B, 2006. Adrenal Insufficiency. Article available online from URL: <http://www.nutritionalhealing.com.au/content/articles-content.php?heading=Adrenal%20insufficiency>.

11. Wilson JI, 2002. Adrenal Fatigue: The 21st Century Stress Syndrome. Smart Publications. USA.

12. Helmreich DB et al, 2005. Relation between the Hypothalamic-Pituitary-Thyroid (HPT) Axis and the Hypothalamic-Pituitary-Adrenal (HPA) Axis during Repeated Stress. Neuroendocrinology 81:183-192. Abstract available online at URL: <http://content.karger.com/produktedb/produkte.asp?typ=fulltext&file=NEN2005081003183>.

13. Dach J, 2010. Adrenal Fatigue. Article available online at <http://jeffreydach.com/2008/07/10/adrenal-fatigue-and-salivary-cortisol-by-jeffrey-dach-md.aspx>.

14. Trace Elements Inc, 2007. Depression Responds to Thyroid Support. E-news updates – for the healthcare professional January – December 2007. Trace Elements Inc.

15. Abdullatif HD et al, 2006. Reversible Subclinical Hypothyroidism in the Presence of Adrenal Insufficiency. Endocrin.Pract. 12(5):572-575. Abstract available online from URL:<http://www.medscape.com/viewarticle/545972>.

16. In-Tele-Health, 2007. Vitamin B1 (Monograph from Hyperhealth Pro CD-ROM).

17. Roberts AJ et al, 2001. Nutraceuticals: the Complete Encyclopedia of Supplements, Herbs, Vitamins and Healing Foods. Berkely Publishing Group. New York, USA.

18. Murray MT 1996. Encyclopedia of Nutritional Supplements. Prima Health, a division of Prima Publishing.

19. Dunne LJ 2002. Nutritional Almanac – Fifth Edition. McGraw-Hill: New York.

20. Vinogradov VV et al, 1981. Thiamine prevention of the corticosteroid reaction after surgery. Probl Endokrinol. 27:11-16, 1981. (cited in Kelly GS, 1999). Nutritional and botanical interventions to assist with the adaptation to stress. Alternative Medicine Review. 4(4):249-265.

21. Wisneski LA, 2000. The Professional Reference to Conditions, Herbs and Supplements. Integrative Medicine Communications.

22. Kelly GS, 1999. Nutritional and botanical interventions to assist with the adaptation to stress. Alternative Medicine Review. 4(4):249-265.

23. Braun L & Cohen M, 2005. Herbs and Natural Supplements. Marrickville, NSW: Elsevier Australia.

24. Whitney Cataldo Rolfes. 2002. Understanding Normal and Clinical Nutrition. 6th Ed. Wadsworth Group: Belmont.

25. Patak P et al, 2004. Vitamin C is an important cofactor for both adrenal cortex and adrenal medulla. Endocr Res.30(4):871-5. Abstract available online at URL<http://www.ncbi.nlm.nih.gov/pubmed/15666839>.

26. Deshpande UR et al, 2002. Effect of antioxidants (vitamin C, E and turmeric extract) on methimazole induced hypothyroidism in rats. Indian Journal of Experimental Biology. 40 (6): 735-738. Abstract available online at URL <http://cat.inist.fr/?aModele=afficheN&cpsidt=13907603>.

28. Guilliams TG, 2000. Adrenal Stress: Measuring and Treating. The Standard Volume 3, No.1.

29. Arthur JR & Beckett GJ, 1999. Thyroid Function. British Medical Bulletin 55 (No. 3): 658-668.

30. Mills S, 1994. The Complete Guide to Modern Herbalism. Thorsons, London.

31. Ghosh D et al, 1994. Mechanism of inhibition of 3 alpha, 20 betahydroxysteriod dehydrogenase by a licorice derived steroidal inhibitor. Structure 15;2(10):973-80. Abstract available online from URL: <http://www.ncbi.nlm.nih.gov/pubmed/7866748>.

32. Rouse J, 1998. Herbal Support for Adrenal Function. Clinical Nutrition Insights 6(9) 1-2.

33. Mills S, 1994. The Complete Guide to Modern Herbalism. Thorsons, London.

34. Wisneski LA, 2000. The Professional Reference to Conditions, Herbs and Supplements. Integrative Medicine Communications.

35. Volger, B.K. 1999. The efficacy of ginseng. A systematic review of randomised clinical trials. Eur J Clin Pharmacol 55:567-575. Abstract available online from URL: <http://www.ncbi.nlm.nih.gov/pubmed/10541774>.

36. Mills S & Bone K, 2000. Principles and Practice of Phytotherapy. UK: Churchill Livingstone.

37. Bone K, 1996. Clinical Applications of Ayurvedic and Chinese Herbs. Phytotherapy Press, Qld Australia.

38. Caso MA et al, 1996. Double-blind study of a multivitamin complex supplemented with ginseng extract. Drugs Exp Clin Res 2:323-329. Abstract available online from URL: <http://www.ncbi.nlm.nih.gov/pubmed/9034759> Allergy Research Group, 2008. Herbal Adaptogens For Asthma And Adrenal Function. Focus Allergy Research Group Newsletter March 2008.

39. Bone K, 2003. A Clinical Guide to Blending Liquid Herbs. Churchill Livingstone, USA.

40. Thomsen M, 2005. Phytotherapy desk reference 3rd ed. Self Published.