TRACE ELEMENTS, INC.
Newsletter

VOLUME 20 JANUARY/FEBRUARY 2009 NUMBER 1

Nutrition And The Neuro-Endocrine Web

----- David L. Watts, Ph.D., Director of Research ----------

Frequently the terms “diet” and “nutrition” are used interchangeably. However, a vast distinction can be made between the two terms. Diet of course is the consumption of foods in any form, while the term nutrition can be used to describe the nutrients obtained from the diet. The importance in recognizing the differences between these terms is that the presences of vital nutrients in foods that are consumed do not insure that they will be absorbed, retained, incorporated or utilized by the body. Therefore, nutrition must be affected by factors other than diet alone. Two of these factors that significantly impact nutritional status include the central nervous system (CNS), and the endocrine system. Generally speaking the Sympathetic branch of the autonomic nervous system, which is stimulating to the metabolic processes, corresponds to a group of endocrine glands that are also considered stimulating. The Parasympathetic branch and corresponding endocrines are considered sedative to metabolic processes. Collectively these relationships form the Sympathetic and Parasympathetic neuro-endocrine system (NES), or the neuro-endocrine web. Paraphrasing the late Dr. Melvin Page, ‘the autonomic endocrine system controls or influences every chemical process in the body, including assimilation and utilization of nutrients.”

The Neurological-Cellular Connection

A two-way communication exists between the cells, tissues, organs and the CNS. Although enzymatic activity is not totally dependent upon neurological activity the CNS does affect eating behavior and metabolism via sympathetic and parasympathetic afferent and efferent nerves. Studies have shown that the autonomic nervous system affects the rate of insulin and glucagon secretions through central and peripheral neural signals. The pancreas is innervated by a branch of the vagus and splanchnic nerves. Electrical stimulation of these nerves readily affects insulin and glucagon output. Specifically, stimulation of the parasympathetic nerves to the pancreas produces an increase in insulin release and sympathetic stimulation inhibits insulin release.

The effects of neurological stimulation upon the liver have also been demonstrated. Excitation of the sympathetic branches to the liver activates the glycogenolytic enzymes, phosphorylase and glucose-6-phosphotase. The effect of neurological stimulation occurred within thirty seconds, which is more rapid than from catecholamine release from the adrenal glands. Parasympathetic stimulation on the other hand increases liver glycogenesis.

Intravenous injection of glucose and insulin in various concentrations also affects neurological discharge rates demonstrating the opposing effects of sympathetic and parasympathetic tissues. These effects are mediated by the hypothalamus. The lateral hypothalamus involving the hunger center and can be categorized as having a parasympathetic effect and the ventromedial hypothalamus, the satiety center has a sympathetic effect.

Metabolic and Nutritional Impact of the Sympathetic NES

The sympathetic NES consists of the following and can be considered stimulatory.

Ventromedial Hypothalamus
Adrenal Cortex (zona fasciculata)
Thyroid
Progesterone
Anterior Pituitary
Adrenal Medulla
Testosterone

Excessive adrenal activity increases the excretion of the minerals calcium and magnesium while increasing the retention of sodium and potassium. An increase in corticosteroids also interferes with vitamin D metabolism.

Excessive thyroid activity is known to promote magnesium losses due its reciprocal relationship with the adrenal glands. An increase in thyroxin stimulates adrenal glucocorticoid secretion. The thyroid and adrenal glands oppose parathyroid activity thereby promoting decreased calcium absorption increased calcium loss and a relative increase in phosphorus retention.

Not only will mineral status be affected by the Sympathetic NES but, mineral co-factors, the synergistic vitamins are also affected. A summary of some of the major macro and micro nutrients affected include:

Increased Retention	**Increased Excretion**
Phosphorus	Calcium
Sodium	Magnesium
Potassium	Copper
Iron	Chromium
	Boron
	Strontium

Increased Vitamin Requirements include:

Vitamin D	Vitamin B2
Vitamin B12	Choline

When overactive, the sympathetic NES contributes to catabolic dominance shifting the cellular pH toward acidity with a corresponding shift in nutritional status and requirements.

Signs of Sympathetic NES Dominance

An increase in sympathetic NES activity results in accelerated cellular metabolic activity leading to increased thermogenesis. This results in warm body temperature and a tendency to perspire easily. Other signs and symptoms include:

Noise sensitivity	Fine Muscle tremors
Insomnia (type 1)	Nervousness
Irritability	Muscle Cramps
Hyperactivity	Elevated blood pressure
Osteoporosis (type 1)	Hyperreflexia
Humoral Immune Dominance	Increased susceptibility to bacterial infections.

Excessive activity of the Sympathetic NES influences fat distribution and contributes to central obesity. Individuals who have chronically elevated sympathetic NES activity are typical type A personality types and subject to many of the stress-related health conditions such as cardiovascular disease, rheumatoid arthritis, high histamines, peptic ulcers as well as the clusters that make up the metabolic syndrome X.

Metabolic and Nutritional Impact of the Parasympathetic NES

The parasympathetic NES is considered sedative in that this group tends to reduce or slow metabolic processes. They include:

Lateral Hypothalamus
Adrenal Cortex (anabolic)
Pancreas (endocrine)
Estrogen
Posterior Pituitary
Thymus
Parathyroid

Nutritional factors affected by the Parasympathetic NES are almost the exact opposite of those affected by the Sympathetic NES. Calcium and magnesium retention are increased while sodium, potassium and phosphorus retention are reduced. These changes in mineral retention and excretion are influenced by parathyroid and insulin secretion. A summary of mineral changes and vitamin status are shown below.

Increased Retention	**Increased Excretion**
Calcium	Phosphorus
Magnesium (relative)	Sodium
Copper	Potassium
Boron	Iron
Strontium	Manganese
	Chromium
	Zinc

Increased vitamin requirements include:

Vitamin A	Vitamin C
Vitamin B1	Vitamin B3
Vitamin B6	Folic Acid

When this group is dominant cellular metabolic activity is generally reduced or slowed. They can also be considered anabolic, producing a shift in the cellular pH toward alkalinity.

Signs of Parasympathetic NES Dominance

Increased Parasympathetic NES activity contributes to a reduction in normal cellular energy production making fatigue prevalent. A reduced blood flow to the extremities can cause cold sensitivity. Other changes may include:

Insomnia (type II)	Osteoporosis (type II)
Hypoglycemia	Low blood pressure
Postural hypotension	Hyporeflexia
Cellular Immune Dominance	Increased susceptibility to virus and yeasts

Changes in body composition include peripheral fat deposition in the hips and thighs producing the pear shaped silhouette. Parasympapthetic NES dominance is closely associated with autoimmune disorders in conditions such as False Multiple Sclerosis, thryoiditis, scleroderma, type II diabetes, chronic fatigue syndrome, fibromyalgia as well as soft tissue calcification leading to calcified lymph nodes, osteoarthritis and premature aging.

Neurological Function and Nutritional Status

Although changes in nutritional status are affected by either NES group, nutritional status can impact neurological activity, particularly sodium, potassium, magnesium and calcium. Increased retention of sodium and potassium produces an increase in neurotransmission and is heightened in the presence of calcium and magnesium deficiency. A deficiency of sodium and potassium along with an increase in the retention of calcium and magnesium reduces neurotransmission potential.

Musculo-Skeletal Changes and the NES

Musculoskeletal changes can develop with dominance of either NES. The hamstrings and adductor muscles may be found weak in individuals with sympathetic NES dominance. Parasympathetic NES dominance leads to weakness of the psoas, gluteus medius, deltoid and biceps muscle groups.

The potential for development of skeletal problems with dominance of either NES groups is obvious. Micro and macro nutrient imbalances can lead to abnormalities in bone formation as well as collagen production disorders.

Conclusion

There are definite metabolic relationships and communications between cells, tissues, organs and systems within the body. The NES plays a significant role in this communication web and is in fact necessary for the normal metabolic cross-talk between organs. Adequate and proper communication between the various systems within the body is affected by the balance between both branches of the NES. This balance between the NES not only affects individual nutritional status, but nutritional balance impacts the efficiency between these important systems.

Just as a computer is required to access the World Wide Web and decipher codes to communicate with a multitude of resources, hair mineral analysis can serve as a tool to access the vast biological web. Proper interpretation of mineral patterns or codes can provide information about the metabolic communication between cells, tissues, organs and systems. Determining a person's NES dominance provides information about past, present and future health issues if unchecked, and more importantly provides information about how to approach therapy of the individual in preventing impending health conditions instead of merely treating symptoms.