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Newsletter

UTILIZATION OF TMA FOR METABOLIC TYPING

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Investigations in biochemistry, physiology, pharmacology, and nutrition are continually supporting the concept of biochemical individuality. Studies have shown that response to pharmacological agents vary widely from one individual to another and is affected by one's nutritional status. The same is true for nutritional responses; therefore, a test to determine metabolic individuality would be beneficial to help in establishing specific individual needs and predicting response to therapy.

BIOCHEMICAL INDIVIDUALITY

Dr. Roger Williams published research data showing that children of the same family had significantly different nutritional needs. Adults of the same age and size in similar environmental settings also showed several-fold differences in their nutritional requirements.(1)

Other investigators have reported their findings that support the basis of biochemical individuality.

Melvin Page, D.D.S. of the Page Foundation determined metabolic types by using anthropometric measurements of the upper and lower extremities in conjunction with blood parameters and other physical characteristics. Dr. Page noted that his findings correlated with certain neurological and endocrine characteristics, which he termed "sympathetic" and "parasympathetic" dominance.(2)

"If any facet of an individual's life history leaves a biochemical mark that can be measured in the laboratory, then this life history marker can potentially be used to specify individuality." Dr. George F. Sensabough, *Forensic Science Handbook.*

George Watson, Ph.D., also recognized individual metabolic types according to what he termed cellular oxidation rates. Oxidation is the process by which adenosine triphosphate (ATP) is ultimately formed. ATP, the major energy constituent of the cell, requires normal functioning of the glycolysis and Krebs cycle for adequate energy production. Each step of these two energy production cycles requires individual nutrients for their completion. A lack of or an excess of specific nutritional factors can contribute to a reduced or accelerated cellular metabolic rate. Thus Dr. Watson used the terms "fast" and "slow" oxidation types.(3)

At Trace Elements, Inc., these concepts have been expanded. Through further research T.E.I. has developed the recognition of metabolic types from tissue mineral profiles which correlate well with these earlier researchers.

TISSUE MINERAL ANALYSIS (TMA)

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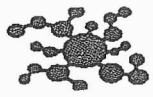
A plausible model for determining metabolic types can be presented through macro and micro mineral patterns found in biopsied human hair. Over the past fifteen years, hair mineral testing has been extensive. A conservative estimate of the number of tests performed during this period easily exceeds one million. Laboratory techniques are probably at their best as a result of this extensive experience. Therefore, sufficient data is available for the acceptance of reference ranges established by the major laboratories in this country.

Considerable evidence has been presented supporting the view that tissue mineral concentrations found in hair reflect intake and that testing hair mineral concentrations is appropriate for evaluating body stores of minerals. (12)



Hair is the tissue of choice for a number of reasons. It is easier to obtain, store and transport than other tissues such as skin, organ or blood samples, and strict in-patient control of the individual is not required. The vast amount of information that can be obtained from TMA profiles is much more economically feasible than what could be determined from blood testing. TMA studies are often more advantageous than blood testing for several reasons. Mineral levels in the blood are maintained at the expense of tissue stores, and thus are not sufficiently characteristic to be useful for individualization.(4) Serum mineral levels fluctuate from moment to moment due to daily variations. They are also altered by sampling techniques,(5) exercise,(6) and acute or chronic conditions such as inflammation, infections and malignancies.(7)(8)

Obtaining hair samples from the same general locations will give the most consistent results. Preferably, samples should be taken from several locations on the scalp(11) just posterior of the ears, from the top, sides, and occipital regions. This is especially important when requesting a Profile 3 for making follow-up comparisons. Samples should not be submitted without noting hair preparations being used by the patient. High quality stainless steel instruments should be used in obtaining the sample to avoid iron contamination from rusty scissors, or chromium contamination from chrome plated instruments.

The value of TMA is not in establishing a diagnosis of absolute trace element deficiencies but to reveal relative deficiencies and imbalances. Mineral ratio determinations are of greater importance than individual mineral levels alone.

As with any diagnostic test, there are limitations, and laboratory tests have to be carefully interpreted. Low levels of a mineral found in the hair do indicate a deficiency,(13)(14)(15)(16) but a normal level does not necessarily rule out a deficiency.(17) This is similar to blood serum and plasma mineral test results in which low, normal, or high values do not necessarily indicate deficiency, normality or excess respectively.(18)(19)(20)

The value of TMA is not in establishing a diagnosis of absolute trace element deficiencies but to reveal relative deficiencies and imbalances. Mineral ratio determinations are of greater importance than individual mineral levels alone. Minerals are both synergistic and antagonistic, and their relative relationships can readily be determined from TMA studies. When used in conjunction with the patient's history, other clinical data, a response to therapy, TMA can be one of the m valuable tools for recognizing trace element nutritic requirements.

ENDOCRINE INFLUENCE ON MINERAL PATTERNS:

The endocrine glands are similar to minerals, that they also have synergistic and antagonistic relati ships. An increase in the activity of one gland will hav suppressing effect upon another. A decrease in activity of a gland will in turn allow increased express of an opposing gland or group, or alter tissue sensiti to its hormone. Alterations in endocrine activity influence mineral metabolism, absorption, retention, a excretion. Because the endocrine glands (hormon influence trace mineral metabolism and trace mine affect endocrine function (hormones) (21), TMA patte may serve as a model in evaluating not only body min ratio stores, cellular metabolic rates, and metabolic typ but may also be used to indicate endocrine relationshi

Extensive clinical research of over 100,000 T studies have shown that certain TMA patterns re metabolic characteristics that correlate well with the scription of earlier investigators. T.E.I. is unique in th comprehensive integrative approach is employed in evaluation and interpretation of TMA assays. T. recognizes two basic metabolic types through TMA p files, each having four subtypes. This is the first and m important step incorporated in the evaluation of TMA sults.

Eight distinctive metabolic categories can identified through properly obtained, assayed and ir preted hair samples. These include the fast metab Types, 1 through 4, and the slow metabolic Type through 4.(22) This discussion, however, will be confi to the fast and slow metabolic Type #1's.

Metabolism is the term used to describe nut utilization or efficiency on a cellular level resultin energy production and maintenance. Cel metabolism is governed by neurological and endoc function, which also affects nutrient absorption, reten and excretion. Dr. Page aptly described this relations "...the autonomic-endocrine system in total control influences every chemical process that goes on in body (including assimilation and utilization of foods...)

Mineral levels in the blood are maintained at expense of tissue stores, and thus are not sufficie characteristic to be useful for individualization.(4)

In order to distinguish mineral patterns associated with either fast or slow metabolism, ideal tissue mineral levels are used. The ideal levels are used in order to more clearly recognize mineral ratio determinations. These ideal levels are within established reference ranges. Reference ranges are established by each laboratory and therefore will vary slightly between laboratories.

"...the autonomic-endocrine system in total controls or influences every chemical process that goes on in the body (including assimilation and utilization of foods...)".

FAST METABOLISM TYPE I

The TMA pattern associated with fast metabolism Type 1 includes the following: calcium and magnesium levels usually below the ideal; and sodium and potassium levels usually above the ideal levels. Phosphorus may or may not be elevated above the mean, but is dominant over calcium. This pattern suggests the following endocrine influence:

Increased Adrenal Cortical Activity (Catabolic Steroids)
Increased Adrenal Medullary Activity
Increased Thyroid Activity
Dominance of the Anterior Pituitary

These are the sympathetic or catabolic glands which are usually synergistic and whose activity is usually elevated. The fast metabolizer is dominant in sympathetic glandular and neurological activity. Sympathetic activity is considered to be stimulatory, therefore resulting in increased cellular metabolic activity. This correlates with the tissue retention of the stimulatory minerals, phosphorus, sodium and potassium.

Increased adrenal activity is suggested by a number of indications in this TMA pattern. First, the elevated sodium and potassium relative to the low calcium and magnesium suggests increased cellular retention of sodium and potassium as a result of increased adrenal function. Increased epinephrine levels will produce potassium retention within the cells,(23)(24) which is mediated by Na-K ATPase.(25) Sodium retention occurs due to an increase in adrenal cortical production of aldosterone, resulting from increased potassium retention.(26) Excess glucocorticoids and aldosterone both increase calcium and magnesium excretion.(27)(28) It is well known that excessive aldosterone secretion induces a magnesium loss.(29) A magnesium deficiency, however, can also promote excessive aldosterone secretion.

Corticosteroids also interfere with vitamin D metabolism,(30) which further contribute to decreased calcium retention.

An increase in thyroid activity promotes magnesium losses, which may be due to the reciprocal relationship between the thyroid and adrenal glands.(31)

This mineral pattern also suggests hypoparathyroidism. Adrenal steroids, particularly glucocorticoids, antagonize the effects of parathyroid hormone.(32)(33) The thyroid gland also appears to antagonize the parathyroid.(34)(35)(36)(37)(38)(39) A decrease in parathyroid activity or tissue sensitivity results in an increase in the tissue retention of phosphorus relative to calcium.(40)

Low tissue copper is frequently seen in the fast metabolizer Type 1 due to increased adrenal stimulation.(41)

PHYSICAL CHARACTERISTICS

Type 1 fast metabolizers can further be identified by the following characteristics which are associated with primary or sub-clinical endocrinopathies, and which can become exaggerated depending upon severity and extent of mineral disturbance. Hyperthyroidism in conjunction with hyperadrenia and hypoparathyroidism energy levels while the body is deteriorating under the effects of stress, or more precisely during exhaustion produces an increase in thermogenesis via an increase in the cellular metabolic rate, resulting in a warm body temperature. The fast metabolizer Type 1 frequently experiences hyperglycemia episodes because of glucocorticoid-insulin antagonism. Calcium and magnesium deficiency symptoms may develop and include; noise sensitivity, hyperreflexia, tachycardia, fine muscle tremors, Type 1 insomnia, (inability to fall asleep easily), nervousness, irritability, and muscle cramps (especially noted at night).

Children with similar mineral patterns as their parent(s) will of course be predisposed to similar health conditions and personality traits.

Elevation of the systolic blood pressure associated with an increase in thyroid activity is often

noted.(42) Depending upon the degree of adrenal activity, diastolic blood pressure elevation may or may not be present. Endocrine influence on fat distribution results in a decrease in peripheral stores and an increase in abdominal storage. The fast metabolizer Type 1, depending upon severity of sympathetic nervous system stimulation, may develop psychoneurosis, anxiety, paranoia, and a marked increase in cerebration.

Generally speaking, the fast metabolizer Type 1 maintains a high state of stress and can be likened to the Type A personality, making the individual susceptible to stress related conditions such as cardiovascular disease, arthritis, allergies (histamine), and peptic ulcers.

CONTRIBUTING FACTORS

There are several factors that can contribute to a person being or becoming a fast metabolizer. This mineral pattern can be inherited from the parent or parents. The majority of children that we test tend to show they are born with a fast metabolic rate. This is necessary for the fast development of the growing child. This pattern can be maintained by the dietary influence of the family. We find that teenagers will have a similar mineral pattern as one of the parents. If both parents are fast metabolic types, then the child will tend to retain this pattern throughout the majority if not all of his lifetime. If parents are slow metabolizers, the child may develop this pattern much earlier in life. Tests of families and twin studies tend to support this view. This may explain many of the so-called inherited health conditions. Children with similar mineral patterns as their parent(s) will of course be predisposed to similar health conditions and personality traits.

Stress is another factor that contributes to an increase in the metabolic rate. Stress produces a retention of the stimulatory minerals, while producing losses of sedative minerals. The effects of prolonged stress in the fast metabolizer results in a vicious cycle. Chronic stress results in the loss of the sedative minerals and retention of stimulatory minerals which further increases stress. As mentioned previously, this eventually contributes to stress related health problems. Personality will also be affected. As the metabolic rate becomes too excessive it causes the fast metabolizer to begin to seek stress both consciously and unconsciously by starting several projects at once, being late for appointments, and always waiting to the last minute to meet deadlines. This characteristic is largely an effort to maintain stage of stress.

We are all under some stress, and not all stress is detrimental. The late Dr. Hans Selye recognized t different stresses as "stress and distress". Distress i type that is destructive, or tears down the body. Ch unrelenting distress is the type that we seemingly no control over.

Stress produces changes in our neurological docrine nutritional status, increasing requirement some nutrients, while decreasing requirements others. This includes the trace elements, vita proteins, carbohydrates, and fats. As an example, s increases sodium retention due to adrenal horm stimulation. Even through a person does not ea appreciable amount of sodium, its retention incre Sodium retention in turn will cause a loss of calciu magnesium, thereby decreasing the requiremer sodium in the diet, but increasing the requiremer extra magnesium.

SLOW METABOLIZER

The TMA pattern found in the slow metabo Type 1 is almost completely opposite to that of the metabolizer. Calcium and magnesium which sedative elements are found to be elevated above mean, while phosphorus, sodium, and potassium usually found below the mean. This mineral pa suggests the following endocrine influence:

Posterior Pituitary Dominance
Increased Parathyroid Activity
Increased Insulin Secretion
Anabolic Adrenal Cortical Dominance

The parasympathetic individual as desc above is dominant in the parasympathetic, or ana glandular and nervous system activity. Since parasympathetic group is sedative in nature, ce oxidative rates are reduced.

Parathyroid hormone activity influences pattern by increasing calcium and magne absorption and decreasing renal reabsorption phosphorus, sodium and potassium.(43) The parath exerts a greater influence on calcium than magnesium. Therefore, a relative magnesium defici usually exists in this metabolic type, resulting in a crease in parathyroid hormone activity.(44)

Decreased adrenal activity is indicated by elevated tissue magnesium level and corresponding levels of sodium and potassium. Excess magnesiu known to decrease adrenal activity.(45)(46)(47)

In a hypothyroid state, the slow metabolizer's intestinal calcium absorption is increased,(48) while renal phosphorus reabsorption is decreased.(49)

Insulin secretion may be reflected by the relative calcium to magnesium levels. A high (greater than 12:1) Ca/Mg ratio suggests increased insulin secretion while a low (less than 7:1) Ca/Mg ratio indicates normal or reduced insulin secretion.(50)(51)

PHYSICAL CHARACTERISTICS

Due to a reduction in the metabolic rate, the slow metabolizer Type 1 may experience the following characteristics: Fatigue which may be contributed to by Insomnia (Type II - falling to sleep easily, but awakening frequently during the night). A patient with this metabolic pattern can often sleep several hours a night, but often wakes up tired; hypotension (especially postural), cold sensitivity (noticed particularly in the extremities), bradycardia, hyporeflexia, and constipation. His diastolic blood pressure may rise and remain elevated depending upon the degree of hypothyroidism.(52)(53) The slow metabolizer Type 1 is susceptible to hypoglycemia, adult onset diabetes, and soft tissue calcium deposition. Due to a tendency to accumulate excess amounts of copper, depression is often noted.

CONTRIBUTING FACTORS

As mentioned previously mineral patterns can be inherited from the parents, and can result in a person developing a slow metabolic pattern. As Dr. Barnes stated in his book *Hypothyroidism The Unsuspected Illness*, when two hypothyroid individuals marry, the chances are great that their children will develop hypothyroidism. Eating habits will contribute to a slow metabolic rate. We find that most total vegetarians have a low metabolic rate. A severe or recurring viral infection will also reduce the metabolic rate. If a viral infection is severe enough a person who was once a fast metabolic type may become slow due to the suppressing effects of viruses. Yeast and fungus also reduce the metabolic rate. Tests of individuals who suffer from Epstein Barr virus, or candidiasis invariable show slow TMA profiles. Of course, stress can also result in a burn-out syndrome causing a reduced metabolic rate due to exhaustion.

Personality characteristics of the slow metabolic Type 1 can be described as a Type B. They are usually perfectionists who are often meticulous and follow projects through to completion. If the metabolic rate becomes excessively slow it can result in withdrawals and a very quiet personality.

CONCLUSION

Manifestation of the emotional and physical characteristics of the fast and slow metabolizer Type 1's depend upon a number of factors, such as the degree of trace element imbalances (including vitamins and amino acids), endocrine activity, and chronicity of these disturbances. The subtypes 2 through 4, have variations of these characteristics.

"...it may be assumed that any test which indicates the functioning ability (normal, subnormal, or supernormal of the individual glands comprising the endocrine system and exocrine) would provide an index to the ability of the body to utilize the food elements which it consumes."

Mild endocrine and trace element disturbances or imbalances are often difficult to detect, especially if the patient is not markedly symptomatic. TMA can serve as an economical screening tool in assessing endocrine influence as it relates to individual nutritional needs. When the results are interpreted and applied to the circumstances of the individual patient, TMA can indicate a more precise and effective nutritional therapeutic approach in many aspects of health-care.(54) Further quoting Dr. Page, "...it may be assumed that any test which indicates the functioning ability (normal subnormal, or supernormal of the individual glands comprising the endocrine system and exocrine) would provide an index to the ability of the body to utilize the food elements which it consumes."

Continuing research and utilization of TMA testing as a routine part of the patient's exam, along with other clinical data may improve its reliability as a primary screening tool for determining metabolic types.

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