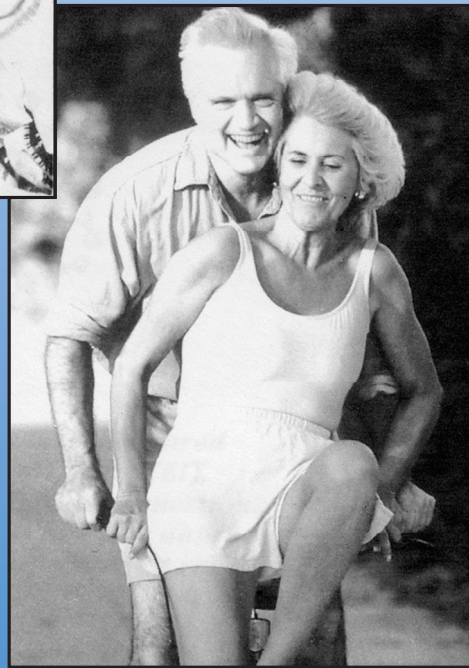
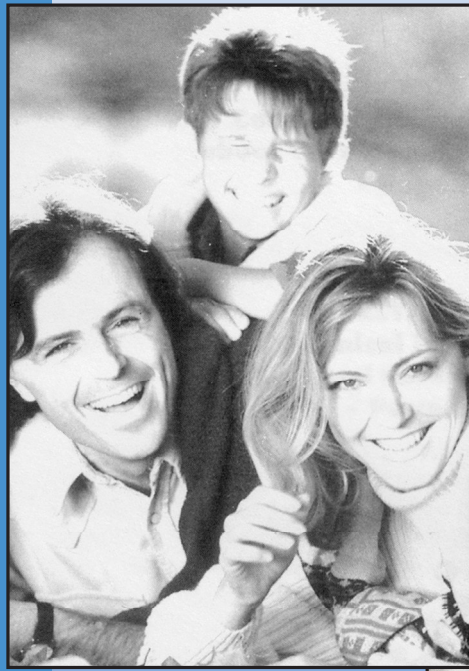


Commonly Asked Questions about Hair Mineral Analysis



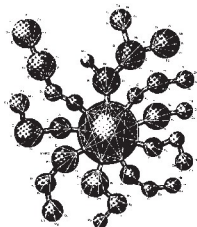
- Reliability
- Accuracy
- Diet
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- Nutritional Supplements
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*This booklet has been prepared
by Trace Elements, Inc. (TEI),
to answer commonly asked questions
about hair analysis and our unique
system of interpreting your test results.*

SECTION I

Commonly Asked Questions about Hair Analysis

What exactly is hair analysis?

Your hair contains all the minerals present in your body, including nutritional minerals as well as toxic heavy metals. Hair mineral analysis is a laboratory test that measures this mineral content in the hair. In most cases, the test results reflect how much of these elements are in your tissues and provide a vivid picture of your internal environment. With this information, a world of metabolic events can be interpreted. Not only can your nutritional status be viewed, but we can also learn much about how efficiently your body is working.

Trace Elements (TEI) is a leading worldwide laboratory. After hundreds of thousands of hair analyses, Trace Elements has developed a unique ability to interpret hair analysis results, which are detailed for you in your TEI Hair Analysis Report.

How can hair analysis help me achieve better health?

If we consider that diet is what we consume and nutrition is what we retain, then we can see that discovering what your body needs when it needs it is a valuable tool in creating health. After 30 years of research, hair analysis has emerged as the most practical method of testing for mineral balance in your body. This valuable tool indicates which supplements you need and which ones you should avoid. And it's no secret doctors of almost every specialty as well as nutritionists and dietitians routinely use hair analysis. Progressive health care providers are now well aware of the vast amount of research linking nutrition to disease. But what serves as good nutrition for one person may not be good for you. Your Hair Analysis Report is designed to help you and your health practitioner determine the best nutritional program for you.

But how do I know that my hair analysis results are reliable?

With a properly obtained sample, hair analysis is extremely accurate. Highly sophisticated instruments and software programs allow for extensive quality control. At TEI, we specialize in hair analysis testing exclusively, analyzing over 50,000 samples per year. Most labs that provide hair analysis services do other laboratory testing as well. But at TEI, our full attention is directed toward assuring the accuracy of your results. (Please refer to Section III for more detailed information.)

What about contamination - hair dyes and soaps - won't these affect my results?

Certain cosmetic hair treatments can contaminate scalp hair such as dyes that contain lead acetate, bleaching processes that artificially affect calcium, and medicated shampoos that contain zinc or selenium. However, only the individual element is affected. All of the other minerals tested are valid. With our extensive ability for interpreting and comparing test results to individual metabolic characteristics, these effects can be overcome.

Doesn't a blood or urine test tell me just as much as a hair analysis test?

Blood tests give information about your mineral levels at the time of the test only. If you've just eaten a banana, your test can indicate a high potassium level, even though you may actually need potassium supplementation. On the other hand, hair analysis results indicate your overall level of potassium - *your actual storage levels over a period of time*, not just what you ate that day or even that week. So a blood test will only accurately report what is being transported in your blood at the time of the test.

Testing for minerals in the urine measures the minerals that are being excreted from your body - not necessarily what has been absorbed as fuel for your body.

So blood and urine tests are like snapshots whereas a hair analysis is the video of your mineral retention.

Why do some people - even some health professionals - say that hair analysis is not a reliable test?

That's an important question. Did you know in the past twenty years there are well over a thousand references in peer-reviewed journals that document and support the reliability of hair mineral analysis? Did you also know that well over 5,000 technical articles are published weekly? Who can keep up with all that new information and still care for patients? At TEI, research is our business. We sift through hundreds of articles weekly including numerous technical journals. About 125 articles are reviewed each week ... over 6,500 articles per year, not including the latest books and Internet medical searches.

Unfortunately, those with limited knowledge or experience are often the most critical. You might ask them what information is the basis for their opinion. How much research have they really done? How much experience do they have using hair analysis?

Will my insurance cover my hair analysis test?

Some insurance companies do cover hair analysis. Almost all will reimburse for the toxic metal screen, but as with most preventative health care, many will not reimburse for elective tests. Please contact your insurance company to check your coverage.

So...hair analysis is widely used and highly accurate. Do I have to be sick or feel badly before using it?

Although most people who have a hair analysis are ill and their doctors are looking for answers to their problems, you do not have to be in ill health to use this valuable tool. Many people use the test for prevention of potential problems, to monitor toxic metal exposure or just to fine-tune their nutritional needs. Hair analysis is routinely performed on world-class athletes who push their bodies to the limit, as well as heads of government and famous singers and actors whose careers depend on their physical well being. So you can see, hair analysis is widely used for people of all ages, from babies to octogenarians and every level of physical condition.

Where do I obtain the hair and how much is required?

Proper collection of the hair sample is extremely important and cannot be over-emphasized. The hair to be collected should be clean and you should not use permed, dyed or bleached hair. The hair should come from several areas of your scalp on the back portion of your head. You simply part the hair and cut as close to the scalp as possible. Cut away excess hair from the sample, leaving about 1 to 1 ½ inches of the root end. The total amount of hair needed is about a tablespoon. If you can't send scalp hair, nails and pubic samples can be used as a last resort. But be aware that the test results may not reflect your most recent mineral patterns because these tissues grow more slowly and sporadic than scalp hair.

Exacting procedures for obtaining a proper hair specimen for analysis can be found in TEI's professional information packet provided to your health care provider.

How is the hair mineral analysis performed?

When the hair specimen arrives at Trace Elements, it is inspected then assigned a laboratory control number and recorded along with all pertinent patient information in our computer database. Afterwards, the sample is finely cut, then weighed accurately to within one-thousandth of a gram of the required weight. The weighed specimen is then placed into an individually marked sterile centrifuge tube in preparation for a precise temperature-controlled microwave/ acid digestion process. The microwave digestion consists of a pre-programmed series of digestion sequences based upon

specific temperature levels. The combination of high temperature and ultra-pure acid will uniformly dissolve the hair strands, thereby releasing the elements contained or held within the protein matrix of the hair. The tube containing the “digested” specimen is then diluted with a special reagent and thoroughly mixed to attain complete homogeneity. The specimen is then ready for analysis using the highly sophisticated ICP-Mass Spectrometry instrument. Upon completion of analysis on the ICP-MS, the test data is automatically transferred into a dedicated computer containing a comprehensive computer program that will analyze each and every test result, including all in-line QC materials. This custom software assists the Chief Chemist and Laboratory Director in reviewing and verifying all data for compliance to strict quality control criteria. Failure to meet these QC criteria requires that the appropriate patient specimens undergo a complete re-analysis. Upon acceptance of all test data, the data is then finally released to the report processing department for printing.

What does the laboratory report consist of?

Trace Elements comprehensive laboratory reports are based upon a vast amount of scientific studies and on-going research conducted by David L. Watts, Ph.D. Each report will evaluate several hundred factors, such as; the nutritional mineral levels, their interrelationships (ratios), heavy metals, as well as your individual metabolic categorization. Your individualized Hair Analysis report takes each of these factors into consideration along with your age, sex and current health symptoms. What emerges is a very comprehensive report complete with graphs and accompanying explanations and recommendations for you and a more technical report for your health care professional. Use of this additional screening test may help you to learn a lot about your body, perhaps answers you have been seeking for years.

Why can't I just take a good multiple vitamin?

We now know more than ever about the interactions of vitamins and minerals. Updating your own knowledge is essential to your future health. You may know that vitamins and minerals are essential for good health, but did you know that they might not always be helpful?

Too much zinc for example can antagonize vitamin D. Therefore, taking zinc indiscriminately may cause an imbalance in vitamin D. Too little vitamin D, in turn, antagonizes calcium, creating poor conditions for calcium absorption. So now you have a shortage of calcium. Too much vitamin C can cause a copper deficiency and allow too much iron to build up in the body. A domino effect occurs. While you may be aware that vitamins and minerals are needed, *too much of something can be just as bad as too little*. In the years to come you'll be hearing a lot more about “over nutrition” (too much of a nutrient) being more of a problem than undernutrition.

Do you see why it's not wise to simply take a multiple vitamin or to increase vitamin C or other nutrients without knowing your particular mineral balance? *You risk creating additional imbalances.*

This sounds complicated. Why don't I just forget about supplements altogether and eat my 3 square meals a day?

That sounds reasonable. But, unfortunately in this day and age, influences never before known to man affect the quality of our food and our capability of absorbing the nutrients from that food.

We all know that the nutrient content of food depends on the soil content. Consider how pollutants in the air, water and food we eat affect the nutrients that we actually get. How does medication you've taken over the years influence your body even now? Then, there are the age-old influences like how activity or lack of it affects nutritional needs. Additional considerations include genetic factors such as metabolic type and other inherited characteristics.

All these factors determine your nutritional needs. Why not use the modern technology available with hair analysis? Then you'll know what you need to take and what you don't.

SECTION II

Commonly Asked Questions about TEI's Hair Analysis Report

Along with your hair analysis from TEI, you receive a unique, in-depth report on your test results. Above and beyond the usual information about individual mineral levels, you will get explanations regarding your most significant mineral readings and their interrelationships - your mineral balance. You will also learn your metabolic type - whether you are a Fast Metabolizer or a Slow Metabolizer. And in addition to a list of recommended supplementation, you will learn what foods you should emphasize and those to avoid that will further assist you to balance your minerals.

My report says that I'm a Slow Metabolic Type. How is this determined from my Hair Analysis Report?

Metabolic typing is a unique feature of TEI's Hair Analysis Report. Based on research conducted by TEI, your mineral levels tell a great deal about your metabolism - that is, the way your body handles nutrients. Dr. David L. Watts has discovered that some minerals actually stimulate or speed up metabolism. Other minerals sedate or slow down metabolism.

If your mineral levels indicate that sedating minerals are dominant in your body, your metabolism will most likely be "slowed down." You would therefore be classified as a Slow Metabolizer. This is an important distinction when it comes to supplementation. You don't want to take sedating vitamins and minerals that could slow your metabolism even more. That's why we have designed a special multiple formula for you called *Para Pack*. It contains only stimulating nutrients and their synergist-helpers.

On the other hand, a Fast Metabolizer would want to take only sedating minerals and vitamins - a special formulation we call *Sym Pack*. So you see, here's another reason why one multiple formula will not fit everyone's needs.

I am underweight. How can I be classified as a Slow Metabolizer?

Weight is not a good indication of metabolic type. A Slow Metabolizer is often overweight. But underweight can occur in a Slow Metabolizer due to poor digestion or poor absorption or even some type of intestinal problem. So while metabolic rate does influence weight gain or loss, it is not the only factor involved.

Why is a mineral recommended for me when it is found to be high on my test results?

Again, this depends on the interrelationships of nutrients we discussed. For example, magnesium may be high. But if it is low in relationship to calcium, a “relative” deficiency exists. Magnesium supplementation is then recommended to improve your calcium-magnesium relationship. It also serves to lower the excess calcium and increase potassium retention (that’s another story).

My report shows that some of my mineral levels are high even though I do not eat foods high in those minerals. How can that be?

This is not unusual. One example that comes up a lot is someone who eats a low sodium diet yet shows a high sodium level. This is where glandular balance comes in. Overactive adrenals can cause sodium retention. This is commonly seen in a Fast Metabolizer. Low sodium diet or not, this imbalance will cause sodium retention.

We can look at this in reverse as well. A Slow Metabolizer who has weak adrenal activity can have a low sodium level even though they eat lots of salt. So, you see that your type of metabolism has to do with the balance of your glandular activity as well as your nutritional status. Your TEI Hair Analysis Report opens up a whole new way to understand your metabolism and learn what’s right for you.

Why is a mineral that is low on my test results not recommended in my supplement program?

Supplement recommendations are based on your unique *overall* mineral pattern, not on the individual levels of minerals. For example, did you know that taking calcium would not necessarily raise your calcium level? Often a low mineral may be brought into normal range by reducing another element that may be “antagonistic” to it thereby enabling you to absorb or retain the deficient mineral better. Or, another element may be added. In the case of calcium deficiency, copper may be recommended because it is known to be effective in improving calcium retention.

I can see how mineral needs can be determined by hair analysis, but my report also suggests certain vitamins. Are vitamins found in the hair as well?

Vitamins are not found in the hair. But vitamins and minerals interact with each other. For example, the activity of vitamin A is greatly reduced in the presence of a zinc deficiency. Vitamin C aids iron absorption. A lack of iron can then indicate a need for vitamin C. Therefore, your mineral pattern can also reveal information about your vitamin status.

My hair analysis results indicate that I have high levels of mercury, yet I don't feel toxic. Why not?

First, the presence of a heavy metal on your report does not indicate toxicity. Toxicity consists of symptoms, which is one way of diagnosing it. Symptoms may appear depending upon how much is present and for how long. Your hair analysis indicates that you may have been exposed to mercury, possibly even as a fetus. Using your supplement recommendations along with eating protein will enhance your body's ability to remove this toxic metal naturally. You may feel temporary discomfort as the mercury moves out of your body. This is to be expected. Please consult your health care professional for more information.

I feel perfectly fine, yet my hair analysis results show several mineral imbalances. Wouldn't I feel badly if I was so out of balance?

A person can feel perfectly fine and still have imbalances. Your test results indicate the current status of your minerals. Depending on how long the imbalances have existed, symptoms may or may not be present.

I'm a vegetarian. How can I modify the dietary recommendations in my Hair Analysis Report?

Presently we do not have a specific hair analysis report for vegetarians, but we have studied hair analysis reports of many vegetarians. We suggest that you follow the ratio of proteins and fats and carbohydrates based on your metabolic type. Simply replace the fleshy proteins with vegetable protein combinations.

I'm on medication. Will that affect my test results?

Drugs do affect your nutritional status as well as your requirements. For example, steroids used for pain control can produce extensive calcium loss. These effects vary with the amount and duration of the drug being taken. Your hair analysis results will show you how to counteract these effects by addressing any imbalance that is now evident. However, some vitamins or minerals can interfere with medications, so be sure to check with your doctor.

My supplement recommendations do not include calcium. Shouldn't I be taking calcium to prevent osteoporosis?

Not necessarily. Many things other than a calcium deficiency can cause calcium loss from the bones. In fact, there are over 30 factors that can cause this. All these factors are taken into consideration in your Hair Analysis Report.

I am pregnant and planning on nursing my baby. Will my pregnancy effect my hair analysis results? Should I take your recommended supplements while pregnant and when nursing?

Pregnancy does produce marked changes in your body chemistry both hormonally and nutritionally. These are reflected in your Hair Analysis Report. And there is no danger to the mother or the child with proper supplementation. You should be re-tested every two or three months during your pregnancy. However, expectant mothers should always be under the care of their doctors.

There are no adverse effects of taking supplements while nursing. In fact, nursing mothers have a special need for staying as healthy as possible.

I hate taking pills. Must I take all the recommended supplements in order to improve?

Doing something is a lot better than doing nothing. Taking your supplements once a day or even once every two days helps to at least maintain your current nutritional status. Remember that your hair analysis recommendations are geared to taking the least amounts of supplements to achieve the maximum result for you.

I have heard that iron can cause serious health problems. Should I be taking it?

You're right. Too much iron has been found to be related to health problems. And the same is true for other minerals and vitamins taken in excess. Excess iron in the body causes free radicals to be formed which are destructive to the cells. This is another good example of how hair analysis can work for you.

With a hair analysis we can determine specifically what you need based on your test results. You will only be taking iron if you need it. So you can follow your TEI Hair Analysis Report recommendations with confidence unless advised otherwise by your doctor.

Do I have to take your supplements or can I use mine?

Feel free to take any high quality nutritional supplements. Your goal should be to select only the highest quality supplements to ensure the maximum absorption of nutrients into your body. Make sure that the minerals are full spectrum amino acid chelates (AAC). Do not accept substitutes such as aspartates, citrates, picolates, gluconates, etc.

A word about the supplements offered by TEI - our *Trace Nutrients* brand.

Trace Nutrients have been developed by TEI over many years of study involving hair analyses on hundreds of thousands of people. Our research has been dedicated to understanding how best to create the most bio-available supplements possible. That is why *Trace Nutrients* are synergistically formulated - they contain the synergist or helper that makes them more easily absorbable and, therefore, cost effective. So when you use *Trace Nutrients Magnesium Plus*, for example, you not only get magnesium, you get its synergist - vitamin B6 - which aids in the absorption of magnesium.

Of course, most of the *Trace Nutrients* product line are hypoallergenic as they contain no wheat, yeast, soy, alfalfa, milk or corn allergens, and no salt, sugar, starch, wax, hydrogenated oils, artificial colors, flavors or preservatives. All of our minerals are full spectrum amino acid chelates to encourage maximum absorption.

How long will it take me to get balanced?

This is a bit complicated to answer. Of course, you are aware that imbalances in your body caused by a lifetime of neglect are not correctable overnight. And as imbalances are corrected, underlying (not yet detected) imbalances may surface.

Have patience! Your good health is worth the effort. This process is much like peeling the layers of an onion - you uncover more and more about your condition with each layer peeled. How you respond depends upon your ability to comply with the recommendations as well as how chronic or severe your imbalances are. But don't rely solely on symptomatic improvements for your progress. A follow-up hair analysis test is necessary to provide you with accurate information on the progress that your body has made toward balance. So be sure to follow up so you can keep up with your body's changing needs as reflected in your follow-up report recommendations.

How much is enough? Well, even if you are already in good health, your hair analysis recommendations are key to knowing exactly what good habits to develop. What foods are best for you? What exact supplements should you be taking at any one time - including what NOT to take? What pollutants particularly cause stress to your body? What types of imbalances are you prone to from mental as well as physical stress? We are dynamic beings affected by day-to-day life events. And our bodies reflect these changes.

The bottom line is this. Knowledge is power. Hair analysis is a tool to help you understand and know what's right for you. Use it as often as every three months to semi-annually. Keep up with the changing demands of your body while you live your life to the fullest.

SECTION III

Technical Information and References

Many research programs for studying and establishing trace element concentrations in human hair have been implemented since 1965 by the International Atomic Energy Agency. These programs were coordinated under Nuclear-Based Methods for the Analysis of Pollutants in Human Hair. Since that time the use of hair as a biological marker has been presented at many scientific conferences worldwide. For example, the Human Hair Symposiums held in Atlanta, Georgia included a vast number of contributors from universities and research centers, some of which include:

| | |
|-----------------------------------|-------------------------------------|
| Cleveland Clinic, Ohio | University of Texas, Houston |
| University of Aston, England | Texas Medical School |
| Emory University, Atlanta | Universidad de Chili |
| CDC Atlanta | Slade Hospital, England |
| McGill University, Montreal | University of TN, Memphis |
| USDA Albany, CA | University of Miss., Hattiesburg |
| University of Leeds, England | Mayo Medical School, Minn. |
| Army Medical Center, Presidio | New York University, N.Y. |
| Wayne State University, Detroit | University of CA, S.F. |
| IAEC, Vienna | University of S.C., Charleston |
| University of Rochester | University of Toronto, Ontario |
| Georgia State University, Atlanta | University of Witwatersrand, Africa |
| Dalhousie University, Nova Scotia | |

Laboratory accuracy.

You can be assured that TEI's mineral testing of the hair is both accurate and reproducible, when the hair is properly sampled and submitted for analysis. The laboratory instruments and equipment in use by Trace Elements are state-of-the-art in the industry, providing high sensitivity and selectivity for all minerals reported. As in most technically advanced labs, all instruments are controlled by computers with highly sophisticated programs for both quantitative analysis and the monitoring of in-line quality control during each daily run. You can further be assured that rigorous, comprehensive quality control and quality assurance programs are maintained to insure continuous adherence to CLIA guidelines for precision, reliability and overall good laboratory practices.

To be more specific, Trace Elements utilizes ICP-Mass Spectrometry for the analysis of all reported minerals. TEI also uses the most advanced temperature-controlled microwave digestion technique available. The laboratory is equipped with a trace element class clean room complete with dual HEPA filtration systems. High sensitivity balances used for calibration/QC check standards and specimen weighing are calibrated with weight sets traceable to

the National Institutes of Standards and Technology (NIST). All stock standards used for daily calibration and quality control are sourced from NIST standard reference material and prepared by a leading ISO 9001 certified laboratory. Additionally, the laboratory uses 16 megohm double-deionized water and acid-leached, triple-rinsed glassware and plasticware. All glassware when used is Class A.

Trace Elements conducts monthly QA/QC studies to confirm and validate all aspects of test methodology, personnel training, laboratory reporting, safety, etc. The laboratory is also continuously evaluating the different aspects of daily laboratory performance, such as; reagents, QC reference materials, split specimen analysis, spiked samples, calibration-verification studies and routine daily monitoring of patient data trends, before, during and after each daily analytical run. This attention to detail assures that you are receiving data obtained by the highest standards. In addition, Trace Elements successfully participates in an on-going international program involving clinical laboratories that utilize high-resolution instrumentation in North America and Europe. Also participating in various other interlaboratory test comparison studies, Trace Elements is committed to reporting the most precise and reliable test data.

TEI is a licensed and certified clinical laboratory that undergoes regular inspections with the Clinical Laboratory Division of the Department of Health and Human Services, HCFA. All clinical laboratories must be certified by this agency and adhere to their established standards and protocol. However, the quality assurance/quality control programs at TEI go far beyond these guidelines and requirements as we are continuously refining and improving this valuable laboratory technique. We are able to do so because our lab is unique in that we specialize in hair tissue mineral analysis. Unlike other laboratories, we do not run countless other clinical tests and only perform hair mineral analysis on a part-time basis. At TEI, our full attention is directed toward hair mineral analysis. Taking into consideration all of these factors, you can truly be assured of accuracy when a properly obtained sample has been submitted for analysis.

Hair analysis as a nutritional screening tool.

Hair is an ideal tissue for nutritional and toxic metal assessment for several reasons. Taking a hair sample is non-invasive, easily collected, stored and transported. All of the important nutritional elements and toxic elements accumulate in the hair. It has been found to be especially suitable for biological monitoring of environmental exposure on a global, regional, and local level. Nutritional assessment using hair mineral analysis has many advantages compared to mineral analysis of other tissues in that it shows retention of minerals by the body. Testing metals in the urine only measure the minerals that are being excreted. The blood gives an indication of the minerals that are absorbed and temporarily in circulation before they are excreted and/or sequestered into storage depots. Blood and urine testing gives an indication of the mineral status of the body only at a specific time. However, mineral concentrations found in the

hair represents long-term intake or exposure making it more useful for nutritional and epidemiological studies.

In today's society individual nutritional deficiencies such as scurvy and beri beri are rare. However, over nutrition and nutritional imbalances are a major problem. As an example, calcium and magnesium work together for many functions within the body. Magnesium alone is responsible for the function of hundreds of enzymes. However, normal enzyme activity can be disturbed not only by a deficiency of magnesium but also when the normal relationship between calcium and magnesium is lost. A person can have adequate amounts of magnesium, but if their calcium is too high, a relative magnesium deficiency exists that can contribute to abnormal function and ultimately adverse health conditions. Not only can individual deficiencies and excesses be seen in a hair mineral analysis, but also the many interrelationships between elements can be viewed and interpreted through a single sample. At present, hair mineral analysis is the most economical and useful screening tool for evaluating nutritional interrelationships in individuals as well as population groups. Follow-up tests also aid in assessing improvements in nutritional status following supplementation, dietary and lifestyle changes.

How vitamin needs can be evaluated thorough hair analysis tests.

Minerals interact not only with each other but also with vitamins, proteins, carbohydrates and fats. Minerals influence each of these factors, and they, in turn, influence mineral status. Minerals act as enzyme activators, and vitamins are synergistic to minerals as coenzymes. Therefore, it is extremely rare that a mineral disturbance could develop without a corresponding disturbance in the synergistic vitamin(s). By the same token, it would be rare for a disturbance in the utilization or activity of a vitamin to occur without a synergistic mineral(s) also being affected. Vitamin D depletion, for example, can be assessed by measurement of its function. Vitamin D is closely related to the minerals calcium, magnesium and phosphorus. A number of syndromes result from vitamin D deficiency, all related to a deficiency or imbalance between the minerals calcium, phosphorus and magnesium. Vitamin C affects iron absorption and reduces copper retention. Boron and iron influence the status of vitamin B₂. Vitamin B₂ affects the relationship between calcium and magnesium. Vitamin B₁ enhances sodium retention, B₁₂ enhances iron and cobalt absorption, and vitamin A enhances the utilization of zinc and yet antagonizes vitamin D and E. Protein intake will affect zinc status, etc. Therefore, evaluating one's mineral status gives good clues to one's vitamin status and requirements. Research at TEI involves recognizing the many synergistic and antagonistic interrelationships between minerals and vitamins.

Differences between hair mineral levels and blood mineral levels.

Minerals circulating in the blood are under a very different homeostatic control than minerals in the tissues. They must be maintained within narrow limits in the blood. This is accomplished even if the dietary intake of a nutrient is very high or very low. Maintaining minerals within a range in the blood is attained several ways. If a mineral intake is very high, the body will compensate by removing or eliminating it as quickly as possible. If the mineral is not eliminated, it will be stored in body tissues. If intake of an element is very very low, then the body will draw from storage areas to maintain blood levels. Once the storage level of a mineral is markedly depleted, then the blood will reflect a deficiency. Other factors affect blood mineral levels such as, stress, inflammation, other disease states, and medications. Therefore, blood mineral levels will not always correlate with tissue mineral status since blood mineral levels are usually maintained at the tissue's expense.

Acceptance of hair mineral analysis?

Hair mineral tests have long been accepted as a routine test for toxic metal screening and investigations of environmental contamination and disease. It has been used extensively for nutritional studies in humans and animals. For over 30 years nutritionists, dietitians, and doctors who are concerned about their patients' nutritional status and who are aware of the vast amount of research showing the relationship of nutrition to disease incorporate hair mineral analysis in their practice as a routine evaluation and screening tool. When a hair sample is properly obtained, analyzed and interpreted, it has proven to be an economical screening tool for toxic metal exposure as well as a good indicator of nutrient interrelationships and nutritional status.

References

Following is a limited sampling of references supporting the use of hair mineral analysis in the research and health care fields.

- **Trace Elements and Other Essential Nutrients.** Watts, D.L. T.E.I., 1995.
- **Hair, Trace Elements, and Human Illness.** Eds. Brown, A.C., Crounse, R.G. Praeger Pub.1980.
- **Hair Analysis. Applications in the Biomedical and Environmental Sciences.** Chatt, A., Katz, S.S. VCH Pub. 1988.
- **Human Hair Vol. 1. Fundamentals and Methods for Measurement of Elements Composition.** Valkovic, V. CRC Press. 1988.
- **Human Hair, Vol II. Trace-Element Levels.** Valkovic, V. CRC Press. 1988.
- **Laboratory Tests For The Assessment Of Nutritional Status.** Sauberlich, H.E., et al. CRC Press. 1984.
- **Trace Substances in Environmental Health.** Ed. Hemphill, D.D. Univ. Mo. Columbia. 1972-1986
- Analysis of Zinc levels In Hair for the Diagnosis of Zinc Deficiency in Man. Strain, W.H., et. al. **J. Lab. Clin. Med.**, 1966.
- Determination of Aluminum, Copper, and Zinc in Human Hair. Stevens, B.J. **Atomic Spectroscopy.** 1983.
- The use of Hair as a Biopsy Material for Trace Elements in the Body. Katz, S.A. **Am. Lab.** 1979.
- Hair Trace Element Levels and Environmental Exposure. Hammer, D.I., et. Al. **Am. J. Epid.** 1971.
- Hair Chromium Concentration of Human Newborn and Changes During Infancy. Hambridge, K.M., Baum, J.D. **Am. J. Clin. Nutr.** 1972.
- Trace Element Nutriture and Metabolism Through Head Hair Analysis. Strain, W.H., et al. **Trace Substances in Environmental Health.** Ed. Hemphill, D.D. Univ. Mo., Columbia. 1974
- Lead in Hair in Children with Chronic Lead Poisoning. Kopito, L., et al. **New Eng. J. Med.** 1967.
- Chronic Plumbism in Children: Diagnosed by Hair Analysis. Kopito, L., et al. **J. Am. Med. Assoc.** 1968.
- Magnesium Content of Hair in Alopecia Areata Atopica. Cotton, D., et al. **Dermatologica.** 1976.
- Hair Manganese Concentrations in Newborns and Their Mothers. Saner, G., et al. **Am. J. Clin. Nutr.** 1985.
- Elevated Hair Copper Levels in Idiopathic Scoliosis. Pratt, W., Phippen, W. **Spine.** 1980.

- Low levels of Zinc in Hair, Anorexia, Poor Growth, and Hypogeusia in Children. Hambridge, K.M., et al. **Pediatr. Res.** 1972.
- Hair Mineral Levels and their Correlation with Abnormal Glucose Tolerance. Tamari, G.M., Rona, Z. **Cytobiological Rev.** 1985.
- Hair and Urine Chromium Content in 30 Hospitalized Female Psychogeriatric Patients and Mentally Healthy Controls. Vobecky, J., et al. **Nur. Rep. Intl.** 1980.
- Hair as an Indicator of Excessive Aluminum Exposure. Yokel, R.A. **Clin. Chem.** 1982.
- Comparison of Concentrations of Some Trace, Bulk and Toxic Metals in the Hair of Normal and Dyslexic Children. Capel, I.D., et al. **Clin. Chem.** 1981.
- Hair Zinc Concentrations in Diabetic Children. Amodor, M., et al. **Lancet.** 1975.
- Blood pressure in Young Adults as Associated with Dietary Habits, Body Conformation, and Hair Element Concentrations. Medeiros, D.M., et al. **Nutr. Res.** 1982.
- Sodium, Potassium, Calcium and Magnesium in Hair from Neonates with Cystic Fibrosis and in Amniotic Fluid from Mothers of such Children. Kopito, L., et al. **Pediatrics.** 1972.
- Cadmium, Copper, Lead, Mercury, and Zinc Concentrations in the Hair of Individuals Living in the United States. **Interface.** 1973.
- Hair Analysis for the Observation of Magnesium Deficiency or Excess. Strain, W. **Magnesium in Health and Disease.** Spectrum Pub. 1980.
- Trace Elements in Scalp-Hair of Persons with Multiple Sclerosis. Ryann, D., et al. **Clin. Chem.** 1980.
- Concentration of Chromium in the Hair of Normal Children and Children with Juvenile Diabetes Mellitus. Hambridge, K.M., et al. **Diabetes.** 1968.
- Interrelationships of Blood and Hair Mercury Concentrations in a North American Population Exposed to Methylmercury. Phelps, R.W., et al. **Arch. Environ. Hlth.** 1980.
- Measurement of Mercury in Human Hair. Giovanoli-Jakubczak, T., et al. **Arch. Environ. Hlth.** 1974.
- On Nickel Contents in Urine and Hair in a Case of Exposure to Nickel Carbonyl. Hagedorn-Gotz, H. et al. **Arch. Tox.** 1977. **Hair Chromium Concentration and Arteriosclerotic Heart Disease.** Cote, M., et al. **Chromium in Nutrition and Metabolism.** Eds. Shapcott, D., Hubert, J. Elsevier Press. 1979.
- Arsenic Concentration in Drinking Water, Hair, Nails, Urine, Skin-Scale and Liver Tissue of Affected People. Chatterjee, D.D., et al. **Analyst.** 1995.
- Arsenic Levels in Hair of Workers in a Semiconductor Facility. De Peyster, A., et al. **Am. Ind. Hyg. Assoc.** Vol. 56. 1995.

- Studies on the Concentrations of Arsenic, Selenium, Copper, Zinc and Iron in the Hair of Blackfoot Disease Patients in Different Clinical Stages. Wang, C.T., et al. **Eur. J. Clin. Biochem.** 1994.
- Beard Calcium Concentration as a Marker for Coronary Heart Disease as Affected by Supplementation with Micronutrients including Selenium. MacPherson, A. Et al. **Analyst.** 1995.
- Hair Chromium Content of Women with Gestational Diabetes Compared with Nondiabetic Women. Aharoni, A., et al. **Am.J.Clin.Nutr.** 1992.
- Cadmium, Copper, Lead and Zinc Concentrations in Human Scalp and Pubic Hair. Wilhelm, M., et al. **Sci.Tot. Environ.** 1990.
- Lithium in Scalp Hair of Adults, Students, and Violent Criminals. Effects of Supplementation and Evidence for Interactions of Lithium with Vitamin B12 and with Other Trace Elements. Schrauzer, G.G., et al. **Biol. Trace Elem. Res.** 1992.
- Concentration of Magnesium in Hair of Inhabitants of Down-Town Krakow, The Protective Zone of Steel-Mill "Hutaim Sendzimira" and Tokarana Village. Solarska, K., et al. **Przel Lek.** 1995.
- Iron, Copper, Cadmium, Zinc and Magnesium Contents of Urinary Tract Stones and Hair From Men with Stone Disease. Durak, I., et al. **Euro. Urol.** 1990.
- Effects of Long-Term Anticonvulsants Therapy on Copper, Zinc, and Magnesium in Hair and Serum of Epileptics. Suzuki, t., et al. **J. Biol. Psychiatry.** 1992.
- Metals in Hair as Biological Indices for Exposure. Foo, S.C., et al. **Int. Arch. Occup. Environ. Hlth.** 1993.
- Mercury Levels in Hair from People Eating Large Quantities of Swedish Freshwater Fish. Okarsson, A., et al. **Food Addit. Contam.** 1990.
- Use of Hair Analysis for Evaluating Mercury Intoxication of the Human Body. Katz, S.A., Katz, R.B. **J. Appl. Toxicol.** 1992.
- Nickel in Nails, Hair and Plasma from Nickel-Hypersensitive Women. Gammelgaard, B., et al. **Acta. Derm. Venereol.** 1990.
- Platinum in the Human Diet, Blood, Hair and Excreta. Vaughan, G.T., Florence, T.M. **Sci. Tot. Environ.** 1992.
- Determination of Hair Trace Elements in Childhood Celiac Disease and in Cystic Fibrosis. Varkonyi, A., et al. **Acta. Ped.** 1992.
- Study of Correlation of Selenium Content in Human Hair and Internal Organs by INAA. Cheng, Y.D., et al. **Biol. Trace Elem. Res.** 1990.
- Emission Spectrophotometric Analysis of Titanium, Aluminum, and Vanadium Levels in the Blood, Urine, and Hair of Patients with Total Hip Replacement. Trinch, V., et al. **J. Orthop. Traumatol.** 1992.
- Hair Zinc and Copper Concentrations and Zinc: Copper Ratios in Pediatric Malignancies and Healthy Children from Southeastern Turkey. Donma, M.M., et al. **Biol. Trace Elem.Res.** 1993

- Hair Zinc and Dietary Zinc Intake During Pregnancy and Puerperium. Carbone, P., et al. **J. Obstet. Gyn. Reprod. Biol.** 1992.
- Relationship Between Zinc in Serum and Hair and some Hormones During Sexual Maturation in Humans. Vivoli, G., et al. **Sci. Tot. Environ.** 1990.
- Trace Elements Nutritional Status. Use of Hair as a Diagnostic Tool. Contiero, E., Folin, M. **Biol. Trace Elem. Res.** 1994.
- Trace Elements in the Hair of Healthy and Malnourished Children. Weber, C.W., et al. **J. Trop. Pediatr.** 1990.
- Study on the Relation of Selenium, Manganese, Iron, Strontium, Lead, Zinc, Copper, and Calcium to Liver Cancer Mortality from Analysis of Scalp Hair. Wang, Y.X., et al. **Sci. Tot. Environ.** 1990.
- Trace Elements in Hair as Related to Exposure in Metropolitan New York. Creason, J.P., et al. **Clin. Chem.** 1975.
- Analysis Of Copper And Lead In Hair Using The Nuclear Microscope; Results From Normal Subjects, and Patients With Wilson's Disease and Lead Poisoning. Watt, E., et al. **Analyst** Vol.120, 1995
- Hair Iron Content: Possible Marker to Complement Monitoring Therapy of Iron Deficiency in Patients with Chronic Inflammatory Bowel Disease. Bisse, E., et al: **Clin.Chem.** Vol.42, 1996.
- Monitoring of Cadmium, Copper, and Lead and Zinc Status in Young Children Using toenail: Comparison with Scalp Hair. Wilhelm, M., et al: **Sci.Tot.Environ.** Vol.103, 1991.
- Traceelements in Full-Term Neonate Hair. Moro, R. et al: **J. TraceElem. Electrolytes Health Dis.** Vol.6, 1992.
- Coronary Atherosclerosis and Chemical Traceelements in the Hair. A Canonical Correlation Study of Autopsy Subjects, Using and Atherometric System and the X-ray Fluorescence Analysis. Fernandez-Britto, J.E., et al: **Zentralbl Pathol.** Vol.139, 1993.
- Hair Analysis of Spastic Children in Hong Kong. Man, C.K., et al: **Sci.Tot.Environ.** Vol.191, 1996.
- Age-Related Decreases in Chromium Levels in 51,665 Hair, Sweat, and Serum Samples from 40,872 Patients—Implications for the Prevention of Cardiovascular Disease and Type II Diabetes Mellitus. Davies, S., et al: **Metabolism.** Vol. 46, 1997.
- Impact of Reduction of Lead in Gasoline on the Blood and Hair Lead Levels in the Population of Tarragona Province, Spain, 1990-1995. Schuhmacher, M., et al: **Sci.Tot.Environ.** Vol.184, 1996.
- Hair Lead Levels Related to Children's Classroom Attention-Deficit Behavior. Tuthill, R.W. **Arch. Environ. Health.** Vol.51, 1996.

