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## Hair Tissue Mineral Analysis: Fact and Fiction

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

The following are excerpts from another significantly flawed article on hair tissue mineral analysis (HTMA) found on the same website. The article titled, Commercial Hair Analysis: A Cardinal Sign of Quackery, was written by a retired psychiatrist. Again, I would like to take this opportunity to respond to these seemingly biased and inaccurate criticisms.

To begin with, just based upon the title itself, it appears that the author is trying to directly associate HTMA with quackery. It is obvious that he has very little knowledge, experience, and understanding on the appropriate application of this laboratory procedure to make such a statement. He further apparently chooses to ignore factual information regarding the procedure even though extensive information is available to him in many respected scientific journals. In fact, even the references the author cites are paltry indeed and certainly no more scientific than the vast number of references available to support hair tissue mineral analysis. Although there are many statements by him that are incorrect or misleading that merit a response, we are taking the time and this opportunity to only respond to a few of his basic assertions.

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*Statement: "Hair analysis is a test in which a sample of a person's hair--typically from the back of the neck--is sent to a laboratory for measurement of its mineral content."*

Response: While this is basically true, the procedure is much more involved than that. There are specific instructions for obtaining a proper sample for testing. The strict protocol for obtaining a hair sample is very important and must be adhered to for accurate results to be obtained. This is true for any laboratory procedure. Protocol for taking a blood sample for example, is not merely, "take blood--usually from the arm--and send it to a lab for analysis". It is well recognized that the location for obtaining a representative hair sample by the clinician is very important in order to perform a valid analysis. The type of cutting scissors necessary for obtaining the hair sample is most often specified, as well as location and length of sample and the total amount needed for adequate testing in the lab. In addition, patient information, such as age, sex, ethnic origin, occupation and current medications are requested. The majority of time, the doctor also provides the clinical symptoms and history as well.

*Statement: "This discussion concerns multi-elemental hair analysis in which a single test is used to determine values for many minerals simultaneously."*

Response: With recent technological advances, it is quite routine for a number of elements to be accurately determined simultaneously from a single specimen. For that matter, simultaneous determinations can and are commonly performed from a single blood sample as well, yet this does not invalidate blood assays. HTMA is a very exacting process involving extensive quality control. When quality control is maintained to normal standards one can expect just as accurate results, if not more so than blood or urine analysis.

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*Statement: "This type of analysis used by chiropractors, "nutrition consultants," physicians who do chelation therapy, and other dubious practitioners who claim that hair analysis can help them diagnose a wide variety of diseases and can be used as the basis for prescribing supplements."*

Response: Apparently the author again has done little research on this subject or chooses to ignore the fact that HTMA is also used by researchers at universities, private institutions, as well as federal and state agencies. Many chiropractors, nutritionists, physicians and other health care professionals do in fact use HTMA in their clinical practices, as they are interested in preventive medicine, however, they also use other clinical tests in conjunction with the history of the patient when making an evaluation. It is widely recognized by reputable professional's that HTMA should only be considered as a screening tool, just as blood and urine tests are considered screening tools. Clinical tests are merely tools to assess patients in order to help form a basis for diagnosis. The

tests themselves are certainly not diagnostic. While we realize that there are some companies, healthcare professionals and individual's masquerading as healthcare professional's that overstep boundaries and make unsubstantiated claims, we believe that this does not negate the obvious benefits of this clinical test. HTMA in conjunction with other clinical data is a very good nutritional screen, and it is far better to make dietary and nutritional recommendations based upon HTMA and other factors than merely guessing at what a person may or may not need.

I also question the intent of this statement by the author, as he apparently is attempting to disparage chiropractic, nutritional consultants and physician's utilizing alternative and preventive medicine in their practice. Each of these groups has contributed greatly to the health and welfare of a vast number of educated individuals who seek them out after traditional medicine has failed them.

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*Statement: "Proponents of hair analysis claim that it is useful for evaluating a person's general state of nutrition and health and is valuable in detecting predisposition to disease."*

Response: There are many reports that confirm HTMA to be useful in evaluating a person's general nutritional status and health. Dr. A. Prasad, is well known for his studies of zinc deficiency in patients suffering from dwarfism. Dr. Prasad found low hair zinc levels in those affected and that supplementing with zinc resulted in increased production of growth hormones that eventually contributed to increased growth and development in the affected group. It should also be noted that the hair zinc levels were found to have increased as well. (AMA Arch. Intern. Med., 1963. J. Lab. Clin. Med., 1963.) Low hair zinc levels have also been found in children with the failure to thrive, along with slow growth rates.

Zinc supplementation again resulted in increased growth rates, elevated growth hormones, and increased hair zinc levels. (Dev. Pharmacol. Thera., 1983). Hair analysis has also been documented to be extremely useful in detecting nutritional disturbances in many disease states. The most recognized being, cystic fibrosis (Kopito, 1972), acrodermatitis enteropathica (Pfeiffer, 1975), cirrhosis (Gupta, 1977), sickle cell disease (Olatunbosum, 1976), PKU (Lines, 1977), Kaschin-Beck and Keshan Disease (Hsu, 1980) cardiovascular disease (Basco, 1978, Klevay, 1975), diabetes (Bio. Trace Elem. Res. 62,1998) (Am.J.Clin.Nutr. 1989), emotional disturbances ( Nutr. and Behav. 1982. J. Learn. Dis., 1983.), and many others.

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*Statement: "They also claim that hair analysis enables a doctor to determine if mineral deficiency, mineral imbalance or heavy metal pollutants in the body may be the cause of a patient's symptoms. These claims are false."*

Response: Hair analysis has been shown to be an excellent tissue to monitor toxic metal exposure in both human and animal studies. Animals receiving 300 parts per million of cadmium in drinking water had an average intake of 4.5 milligrams over 12 weeks. Peak levels were reached in the liver, kidneys and hair in 4 weeks. In animals exposed to lesser amounts, a peak was reached at 7 weeks in the kidneys, and 9 weeks in the liver and hair. Blood levels remained consistently low despite continuous exposure, and did not correlate with or reflect kidney or liver concentrations. Whereas, hair cadmium levels did correlate with kidney and liver concentrations. It has been concluded by this and many other studies that hair can be used as an indicator of whole-body accumulation, and that blood is not a good indicator of accumulation. (Dep. Hyg. Karolinska Inst. Stockholm. Arch. Environ. Health , 1972)

A nation-wide survey of 1774 children 1-5 years of age was performed on those living near lead smelters and those not exposed to smelters. The results of the study revealed that blood levels of the heavy metals were not elevated in most of the exposed children; whereas, elevated levels of lead and cadmium were detected in the hair, thereby providing evidence of exposure. (Am. J. of Epidem., 1977). Hair analysis can also be used to evaluate the nutritional status and toxic metal exposure of the fetus through the testing of the mother's hair (Arch. Environ. Hlth., 1974), as well as to monitor the use of addictive drugs (JAMA 1989).

Human hair has been accepted as an effective tissue for biological monitoring of toxic heavy metals by the U.S. Environmental Protection Agency, and is being used for this purpose throughout the world. It is ideal in that it fits the following criteria;

- 1) Hair accumulates all the important trace elements.
- 2) It is a commonly available tissue.
- 3) It is widespread geographically.
- 4) Hair is easily collected, stored and transported.
- 5) It is suitable since specimens can easily be re-sampled.
- 6) It is present in polluted and non-polluted areas.
- 7) The content of the hair correlates with environmental gradients of metals.
- 8) There is sufficient background and exposure data.

Hair is especially suitable for biological monitoring for exposure assessment as well as global, regional, and local surveillance monitoring. The use of hair has advantages over other tissues. Monitoring metals in the urine measures the component that is excreted. Blood on the other hand, measures the component that is absorbed and temporarily in circulation before it is excreted and/or sequestered into storage depots. (EPA 600/3-80-089, 1980)

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*Statement: "In 1974, the AMA Committee on Cutaneous Health and Cosmetics noted: "The state of health of the body may be entirely unrelated to the physical and chemical condition of the hair. Although severe deficiency states of an essential element are often associated with low concentrations of the element in hair, there are no data that indicated that low concentrations of an element signify low tissue levels nor that high concentrations reflect high tissue stores. Therefore hair metal levels would rarely help a physician select effective treatment."*

Response: First, we would have to assume that this committee formed their opinion without having any data of it's own, and I think it would also be safe to say that they did not look for any additional data. Second, I would assume from the title of this committee that they are composed of a group of dermatologists, and if so, again a group with virtually no knowledge of the utilization of HTMA. However, once again we do not argue with their rights to express their opinion. An opinion which has no relevance as this committee had no power to evaluate, suggest, control, or regulate any clinical test or clinical laboratory.

It should be noted that blood tests in many cases do not reflect the state of health of the body, and can be entirely unrelated to the physical and chemical condition of the body. Even though severe deficiency states of an essential element are often associated with low concentrations of the element in blood, it does not indicate that low concentrations of an element signify low tissue levels nor that high concentrations reflect high tissue stores. Therefore, by this committee's own standard, blood testing would rarely help a physician select effective treatment.

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*Statement: "Most commercial hair analysis laboratories have not validated their analytical techniques by checking them against standard reference materials. The techniques typically used to prepare samples for analysis can introduce errors for many of the elements being determined."*

Response: Commercial hair analysis laboratories like their commercial blood lab counterparts are required to validate each and every test before releasing a single result to the physician. Furthermore, all licensed and certified clinical laboratories in accordance with established guidelines as set forth by the accrediting and reviewing agencies follow strict quality control and quality assurance protocols for all test methodology and procedures. Non-compliance with these requirements can result in loss of licensure as a clinical laboratory, whether the lab performs tests using hair, blood, urine or a combination of these.

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*Statement: "Hair mineral content can be affected by exposure to various substances such as shampoos, bleaches and hair dyes."*

Response: The contribution of elements from the environment and some types of hair preparations are well known. Precautions for obtaining a proper representative sample is well known in the industry and in the literature. This information is routinely provided to all clinicians from reputable laboratories.

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*Statement: "The level of certain minerals can be affected by the color, diameter and rate of an individual's hair, the season of the year, the geographic location, and the age and gender of the individual."*

Response: Accurate test results are based upon a number of important factors, such as; the clinician obtaining specimen from several different locations of the scalp, collecting the proper weight and length, and finally the chemists and technicians adhering to established and accepted laboratory methods and procedures. Adherence to these generally accepted guidelines for sampling will reduce any significant effect of color, diameter and rate of growth. In addition, seasons do not significantly affect mineral levels found in the hair except in cattle whose entire food supplies are changed seasonally. Geographic location can and will affect an individual's or group's nutritional mineral status. This is quite obvious as individuals living near polluted lakes, streams and factories can have elevations of specific toxic metals compared to groups and individuals not living near the pollutants. In fact, the very nature of local soils and water would naturally result in differing mineral patterns in the individual. This would therefore result in disease predisposition in geographic regions of a country, making HTMA very useful in evaluating communities as well as individuals.

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*Statement: "Normal ranges of hair minerals have not been defined."*

Response: This is somewhat true, as currently no U.S. government agency has established an "official" standardized set of reference values for all of the elements available for testing. However, in the absence of standardized reference values, HTMA labs like all other clinical laboratories testing blood, urine, etc., are directed by and held responsible by the agencies which inspect and license them to establish laboratory-specific reference ranges for each and every assay that is performed. This is accepted standard clinical laboratory procedure.

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*Statement: "Hair grows slowly, so even hair closest to the scalp is several weeks old and thus may not reflect current body concentrations for purposes of health diagnosis."*

Response: This is exactly what makes HTMA a valuable test for the physician. Trace element concentrations of the hair represents time-weighted exposure values, which makes it much more useful for epidemiological, and nutritional studies. Blood serum or urine testing on the other hand, gives an indication of the status of the body only at a specific time; the time the sample was obtained.

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*Statement: "The use of a single multi-elemental hair analysis test as the sole means of diagnosis violates basic tenets of medical practice that laboratory findings should be considered together with the patient's history and physical examination, and that the practitioner should keep in mind that laboratory errors occur."*

Response: On this I wholeheartedly agree. Diagnosis using one single laboratory test, whether hair, blood, urine, saliva, etc., is not recommended and this is stressed by all reputable laboratories and healthcare professionals.

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*Statement: "In 1983 and 1984, I sent hair samples from two healthy teenagers to 13 of the commercial laboratories. In 1985, I sent paired samples from one of the girls to five more labs. The reported levels of most minerals varied considerably between identical samples sent to the same laboratory and from laboratory to laboratory. The laboratories also disagreed about what is*

*"normal" or "usual" for many of the minerals, so that a given mineral value might be considered low by some laboratories, normal by others and high by others."*

Response: The results described above would be expected in this small study for several reasons. First, the author used his daughter and a girlfriend to obtain a sufficient amount of sample in order to submit 26 specimens in all. He cut one extremely long set of strands from each girl, cut these into smaller segments, mixing the proximal hair (closest to the scalp) with the distal hair (furthest from scalp) and then dividing into the 26 samples. This first step by the author violated a cardinal rule for obtaining a proper hair specimen. That is, the hair specimen must be taken within the first inch and one-half closest to the scalp. It is well known in the available scientific literature that significant variations in test results of longer specimens will occur as even the author himself has acknowledged in the past. For this reason, most laboratories inform the physician of the proper method to obtain a representative sample. Second, his procedure assures that none of the samples will be representative of recent hair growth. The fact that some of the test results between several laboratories did not agree is of absolutely no surprise since the samples could not have possibly been identical. It is also important to note that only if the sample was truly homogenous could a reputable researcher distribute specimen to a number of laboratories with any expectation of obtaining similar results, whether a standard blood lab or any other specialized clinical laboratory. However, despite the seemingly apparent effort to obtain significant variations in the results, an actual statistical review of the author's data revealed a great number of similarities that were neglected or overlooked by the author in his conclusion. The view that the author was biased and displayed many faults common to statistical conclusions is also supported in a critical review of the author's study by Stephen J. Schoenthaler, Ph.D., in *The International Journal of Biosocial Research* (Volume 8(1): 84-92,

1986). In it Dr. Schoenthaler concludes the author's , "... hair samples are: (1) unreliable; (2) fail to develop a test hypothesis; (3) do not offer a two-sided literature review; (4) create the possibility of receiving invalid interpretations from the lab by using a faulty cutting procedure; (5) state that he converted his ordinal level data back to raw interval level scores before calculating his test statistics; and, (6) considers only his own data when writing his conclusions."

#### **Judicial Support:**

The author cites one example of a court case initiated by the FTC that purportedly ruled against a hair analysis laboratory. The truth is, from that extended case in 1985, Judge Brian of the Federal District Court of Alexandria, Virginia, stated that HTMA was a *"... useful guide in the hands of a health care professional"* and that when *"used along with other relevant information in the treatment, the results of this procedure can help in prescribing nutritional supplements and in the caring for a specific patient where a chemical imbalance in the body is suspect."*

#### **Research Support:**

It should be noted that there have been many research programs for studying and establishing trace element concentrations in human hair that 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 many scientific conferences have been held to present the use of hair as a biological marker and the development of analytical techniques applied to hair mineral assay. These Human Hair Symposiums included a vast list of contributors from many 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 Miss., Hattiesburg
- University of TN., Memphis
- USDA Albany, CA.
- University of Leeds, England
- Mayo Medical School, Minn.
- Army Medical Center, Presidio
- New York University, NY
- Wayne State University, Detroit
- University of Ca., SF
- IAEC, Vienna
- University of SC, Charleston
- University of Rochester
- University of Toronto, Ontario
- Georgia State University, Atlanta
- University of Witwatersrand, Africa
- Dalhousie University, Nova Scotia

Other contributors and further reading can be found in HAIR, TRACE ELEMENTS AND HUMAN ILLNESS. Ed. Brown, AC, Crouse, RG. Prager Pub. 1980.

It should be emphasized that most of the criticism directed toward hair mineral analysis is from data that is over 20 years old. However, there has been a great deal of research since then and especially in recent years, leading to improved laboratory techniques, and procedures. Laboratory instrumentation is far advanced over the early equipment. In fact, advances in this area can be compared to the advancements in computer technology, which everyone knows, is never at a standstill. Over the past few decades virtually millions of analytical tests have been performed on hair samples throughout the world. Laboratory techniques, procedures, instrumentation, and reporting have been well refined. You can be assured that when a hair sample is properly obtained, analyzed and interpreted, it is a proven economical screening tool for toxic metal exposure as well as a good indicator of nutrient interrelationships and nutritional status of the individual.

**Conclusion:**

It seems unreasonable for HTMA to be subjected to such strict expectations and blatant bias. If other laboratory tests were to be scrutinized as much and in the same biased manner, they would also be considered highly questionable. HTMA is the most accurate method available as a nutritional screening tool. Perhaps if it was being used as the basis to prescribe drugs, it would be more readily embraced by traditional allopathic medicine.