Medical Anthropology
by Tim Batchelder, BA
www.anthrocode.com • timbatchelder@hotmail.com

Hypothyroidism, Temperature Regulation, and Ethnoscience

As spring opens up the Northern hemisphere to a variety of outdoor activities, many people flock to nature. However, unlike our ancestors, who developed rapid physiological adaptations to outdoor activity and temperature changes through adjustments in basal metabolic rate, circulation and thyroid production, we have largely lost this ability since we have turned so fully to culture to protect us. Further, many modern humans have developed health conditions such as hypothyroidism and circulatory problems that make participation in outdoor activities difficult even with the technologies of culture.

Hypothyroidism is an increasingly common disorder that results from insufficient production of thyroid hormone, a hormone essential for controlling body temperature and metabolism. As many as 40% of people in the US may not be able to make enough thyroid hormone which can lead to heart problems, fatigue, memory problems, cold hands and feet, brittle nails, hair loss and dry skin.

Physical anthropologists have pioneered the study of human adaptation to various temperature extremes from past to present and have recently turned their attention to thyroid function as it relates to environmental variables. In this column, I’ll use this novel viewpoint of physical anthropology to examine ways that people can increase their tolerance to outdoor temperature fluctuations and overcome hypothyroidism.

Basal Metabolic Rate, Thyroid Production and Climate

A study by Leonard W. M. Sorensen, V. Galloway, G. Spencer, M. Mosher, L. Osipova, and V. Spitsyn entitled “Climatic Influences on Basal Metabolic Rates among Circumpolar Populations,” appearing in the American Journal of Human Biology (2002), notes that indigenous people of northern latitudes have higher BMRs than tropical people as an adaptation to the colder climates. They found that thyroid function is strongly shaped by environmental factors such as changes in temperature and nutrition. Bojko (1997) found that Russian men in a mining community in Svalbard archipelago — one of the northernmost outposts in the world — had much higher thyroxine levels during the winter months than in the summer. Similar research done on the indigenous Nenet and non-indigenous Russian men in the Arkhangelsk region of Russia found a major increase in T4 during the winter, however, again the indigenous people showed an even greater increase. These results suggest that the increased thyroid hormone levels during the winter may be increasing basal metabolism in response to severe cold and short day lengths of the arctic winter. Likewise in Siberia, indigenous (Evenki) and non-indigenous Russian subjects showed a difference in thyroid levels with indigenous people showing the highest levels. The elevations are between 7 and 19% for indigenous men and 3 and 17% for women above predicted values! This may be in part due to a diet richer in fat and protein but with the increasingly mixed "white man’s diet" consumed by these groups, diet cannot be accounting for all of the increase in BMR, and genetic and short term physiological adaptation through increased thyroid production is also important. The authors note that evaluation of BMR through fat-free mass has become the preferred method due to variability in body shape across populations in comparison to older norms based on surface area. FFM is considered the best single predictor of energy expenditure in humans. Indigenous groups appear to have a greater capacity for elevating BMR in response to severe cold.

Caffeine, Calcium, and Body Fat

Besides physiological adaptation to cold temperature through elevated thyroid and BMR, other short term dietary and lifestyle factors are shown to directly affect thyroid function. Anthropologists Martin and Crawford (1998) report that caffeine consumption, blood calcium level, and biceps skinfold thickness are related to thyroid function. The data for this study were collected from three Mennonite communities, two in Kansas and one in Nebraska as part of a multidisciplinary study of aging.

A significant positive relationship was found to exist between caffeine intake and thyroxine level. To date, there has been no specific study of the relationship between thyroxine and caffeine. Previous studies have demonstrated that thyroid hormones increase the level of adenylate cyclase activity and the cellular cyclic AMP (cAMP) level (Segal et al. 1985, 1989). cAMP is a secondary messenger for the action of many hormones. When hormones attach to their receptors on the plasma membrane, cAMP provides the necessary energy for the hormonal action (Stryer 1988). Thyroxine uses cAMP as a secondary messenger and caffeine acts synergistically with thyroxine in this regard.

Previous studies identified a relationship between thyroxine and calcium level (Davis et al. 1983; Segal et al. 1985, 1989). Segal et al. (1989) suggested that this relationship is due to calcium’s regulation of thyroxine activity. Thyroxine can regulate blood calcium levels by releasing calcium from the cells. The relationship between calcium and thyroxine may explain why postmenopausal women are particularly prone to osteoporosis since postmenopausal women have lower levels of thyroxine. After menopause there is less thyroxine in the bloodstream; thus less thyroxine enters the cells and less calcium is released. The body continues to require the same level of calcium, and therefore calcium is removed from bone.

Biceps skinfold thickness is positively correlated with thyroxine level and may be explained through energy balance. Individuals with prolonged positive energy balance have higher thyroxine levels because additional thyroid hormone is required to metabolize the surplus food intake. Biceps skinfold thickness
is the best predictor of thyroxine level because the biceps maintain a significant portion of muscle in most individuals and thus are less likely to be a storage area for fat which occurs in hypothyroidism (Despres et al.1988; Lohman 1992).

Environment, Diet and Mind-body Factors

During my field research in Kauai (see http://anthrocode.com/kauaitrip.htm) I spoke with ethnobotanists who noted that traditional people living near the coast rarely suffer from hypothyroid conditions due to the high levels of sea vegetables in their diets. I've also conducted field workshops with one of the leading authorities on sea vegetables and thyroid function, ethnobotanist Ryan Drum, PhD, who explained that some components of sea vegetables may actually mimic thyroid hormone in the body, which may provide an additional explanation of why they support the thyroid, even in people whose iodine intake is adequate. I visited Dr. Drum in the San Juan Islands of Washington State where he harvests all his sea vegetables from pristine waters and noted that it is important to obtain them from a high quality manufacturer who assures that they are harvested from clean waters. Due to their chelating action sea vegetables concentrate pollutants, particularly heavy metals. Kelp is particularly useful for thyroid regulation (see my previous article on marine drugs http://anthrocode.com/marinedrugs.htm ). Other sea vegetables such as bladderwrack are also rich in iodine and are just as effective as kelp at supporting the thyroid. Incidentally, sheep farmers in the Great Lakes found that adding iodine to their animal's diet improve the quality and quantity of wool production immediately through increased thyroid gland performance.

Throughout evolution, humans consumed a primarily vegetarian diet. But note the word primarily. Small amounts of non-plant protein were almost certainly consumed in the form of insects dwelling in plant materials, microorganisms, as well as the occasional scavenged meat source. Some animal proteins in the diet may be important for people at risk of hypothyroidism since they may have difficulties converting beta carotene to vitamin A without the presence of bile salts (fat) from animal proteins. This conversion is inefficient at best in people without thyroid problems: it takes 4-6 units of carotene to make one unit of vitamin A. The importance of sunlight for thyroid function may be related in part to the increase in vitamin D which it causes, which is only found in animal foods. It has long been known that consumption of vegetables in the Brassica family can inhibit thyroid function.

An outdoor lifestyle seems protective against hypothyroidism as described in the above anthropological studies of various indigenous populations. One reason may be exposure to sunlight. Morning light advances physical activity, hormone secretion, urine output, body temperature, and stimulates the thyroid to burn body fat, while evening light makes the same events occur later. Farm animals living outdoors don't fatten as easily as those living indoors. UV stimulates the thyroid to increase metabolism, which burns calories (Lamberg: 1994). In the 1930s Swiss sun therapists found clients had little fat even without exercising for months and well-functioning thyroid glands. (Kime and Lohmeier: 1986). Two hours of bright light in the morning reduces nocturnal restlessness in patients with Alzheimers as well as SAD, an affective disorder related to depression, by increasing serotonin levels. In industrial societies children experience growth spurts during the spring as their metabolism speeds up and thyroid hormones peak.

Last, the presence of a supportive and tactile community is vital for optimal thyroid function. Rats whose thyroid and parathyroid were removed survived if they were in a colony in which they were petted by keepers. These rats were much less timid. They were 6 times as likely to survive. Mother rats stroke pups vigorously with their tongue which releases growth hormone. (Hammett, FS: 1921, 1922.) Rats handled frequently during early development have more active immune responses (Solomon, Levine and Kraft: 1968). Some people who suffer from hypothyroid may have dreams that feature still people and a lack of movement, according to Dossey. People with hypothyroidism may feel lonely and alienated and many suffer from daytime sleepiness and fatigue, cold intolerance, eye puffiness, hair loss and other appearance issues, depression and other factors which limit their motivation to participate in social events.

I should also note the pioneering research on environmental medicine for soldiers in combat being explored at the US Army Natick Labs near Boston. Here researchers, including physical anthropologists, are investigating ways to help troops adapt to cold temperatures by altering metabolism and endocrine function.

The Electromagnetic Background and Other Environmental Hazards

Over the past 10 years I have worked with professionals in information technology and have been amazed at the prevalence of various signs and symptoms of hypothyroidism, including hair loss in uniform density across the scalp even in young men (and increasingly women) in their twenties and thirties working in this industry. Trying to find a cause for this problem I suspect it may be related to exposure to electromagnetic radiation from computer CRTs and other related electrical devices in the workplace since I noticed the most severe hair loss among people who spent the most time working closely with these machines. I have since started looking at ways to reduce the risk of exposure including low EMF computer equipment by conducting ethnographic research to see how people actually use this technology and how it is affecting their health.

The background electromagnetic field in which humans function has changed dramatically since industrialization, which may be linked to hypothyroidism. EMFs exhibit a suppression of the immune response, especially upon the endocrine system, indicated by red and white blood cell counts. Thyroid gland stimulation and resulting increase of basal metabolic rate have also been documented in human studies at power densities well below the American safety guideline of 10,000 microwatts. ELF fields at 50Hz depress thyroid activity in animal experiments.

The threat of radiation exposure from low level weapons use in terrorist assaults or more practically, the constant exposure of many people due to inappropriate disposal and use of radioactive elements and the nuclear energy industry is another source of thyroid dysfunction. As part of the Audubon Expedition Institute in 1994 our team conducted field ethnographic research at the Hanford nuclear power plant in Washington State where the federal government acknowledged intentional and accidental radiation releases during the early years of the Cold War. We questioned workers and local residents about their experience with radiation exposure from the plant and found that residents downwind from the facility were likely to have ingested radioactive iodine from Hanford releases and suffered from many health problems related to radiation exposure including thyroid cancer. A panel of the National Academy of Sciences has also recently found that research on long term effects of this release upon local residents may have been inadequate.
Numerous hormones and hormone blockers are now showing up in surface waters and organisms across the US as a result of industrial activity and even disposal of common pharmaceuticals and dietary supplements. This may be linked to the rise in hypothyroidism as well as hyperthyroidism in humans. For example, paper pulp mills create androstenedione as a byproduct of their manufacturing process which has turned many female fish in streams around the plants male in appearance (including male reproductive organs), while simultaneously allowing them to become pregnant. It also represents the first environmental androgen – a pollutant that functions like a male sex hormone – ever discovered in nature. In people, andro binds to receptors on cells and triggers the production of testosterone, the body's primary androgen. Andro was found present in one river at 15 nanograms per liter which is a typical level and is at especially high levels in the river sediment. At an October 2000 environmental endocrine symposium, hosted by the Center for Bioenvironmental Research (CBR) at Tulane and Xavier Universities in New Orleans, scientists reported finding at least three more compounds that bind to the androgen receptor including progesterone, a female sex hormone that can have androgen-like effects by opposing the actions of the body's primary female sex hormone, estrogen. Male fish appear to be dramatically stunted or "precociously masculinized." Female fish exposed to environmental androgens appear to be unusually aggressive. Thyroid hormones and TH blockers have also recently emerged in the environment as a result of industrial activities and pharmaceutical disposal.

Western Pharmaceuticals and Supplementation

A Western approach to hypothyroidism involves a blood test to diagnose it followed by a prescription for synthetic thyroid. Another way to diagnose this disorder simply involves taking the underarm body temperature (constant basal body temperature) for 15 minutes upon rising in morning. If the temperature is below 97.6 degrees, an underactive thyroid gland may be indicated. Using natural products a typical dose of one grain of thyroid a day (natural source) is the preferred treatment for hypothyroid since synthetic thyroid is not shown to be as effective though Western health professionals will often argue it is more consistently dosed. This presents a problem for strict vegetarians. New Zealand sheep are the current best source (pesticide-free, free-range, no antibiotics, steroids.) Metagenics is a recommended brand. Be sure to obtain freeze dried product which preserves nutrients. T3 (natural) thyroid has a half life of 12 hours so you can take it two times per day versus synthetic thyroid which has a 3 hour half life. Thymosin is another product to look into since various antigens or foreign proteins can pass through the intestinal wall without being broken down. Other useful products mentioned by James Duke in The Green Pharmacy include:

- Gentian, which provides bitter compounds known to normalize the functioning of the thyroid. A combination of gentian, red pepper (cayenne), Irish moss, kelp and saw palmetto is a recommended formula.
- Radishes which have long been used in Russia for treating thyroid problems, according to medical anthropologist John Heinerman, PhD. Russian researchers note that one chemical in radishes, raphanin, helps keep levels of thyroid hormones in balance.
- Guggul, which is shown to improve thyroid function and increase weight loss by enhancing metabolism according to one three-month study reported in the Journal of Ethnopharmacology (1991).
- Forskolin which may raise cAMP levels in cells, dilates blood vessels and may increase thyroid hormone secretion.
- Mustard greens which are a great source of tyrosine, an amino acid used to make thyroxine, which is also found in decreasing order in velvet bean seeds, carob, winged beans, bean sprouts, lupines, soybeans, oats, peanuts, spinach, watercress, sesame seeds, butternut squash, chaya, chives, fava beans, lamb's quarters, pigweed, pumpkin seeds, snowpeas and cabbage.
- Rhodiola which has a central stimulant action and increases tolerance to anoxia, fatigue, microwave irradiation, poisoning by strychnine, tetanin, and other toxins, regulates brain functions, leukocyte count, blood glucose, promotes protein hydrolysis, and enhances the functions of the thyroid gland, adrenals, and ovaries.
- Walnuts which are used as remedies for various glandular disorders, including thyroid problems, in Turkish folk medicine. In one study, the fresh juice of green walnuts doubled levels of thyroxine. A decoction of green walnuts, made by boiling them for about 20 minutes, boosted thyroxine at least 30%, according to Duke.
- Other important drugs for hypothyroid include bugleweed, lemon balm, self-heal and verbena. These same herbs also help with Graves' disease, a condition that involves too much thyroid hormone, because they seem to have the ability to normalize thyroid hormone levels.

Eastern Pharmaceuticals

Subhuti Dharmamanda, PhD, Director, Institute for Traditional Medicine, Portland, Oregon has an excellent article online on the TCM approach to thyroid disorders at http://www.itmonline.org/arts/thyroid.htm in which he notes that current medical treatments for hypothyroid are insufficient because it is so hard to regulate levels of thyroid hormone in the body using supplements or drugs. Yet he notes that thyroid disease is commonly treated in China using herbs. The fatigue, water retention, and chills characteristic of hypothyroidism are standard symptoms belonging to traditional categories such as qi and yang deficiency. Hypothyroidism produces a pale tongue appearance. This is believed to be a direct reflection of changes in basal metabolic rate which influences blood circulation to the tongue. The tongue may be flaccid in hypothyroid cases. The pulse is slow, soft, and deep. Patients with kidney yang deficiency syndrome often suffer from decreased levels of T3 and T4 in particular. The basic herbal treatment for hypothyroidism is to administer qi and yang tonics. These are all tonic prescriptions that enhance function of the stomach and spleen, nourish the blood, and stimulate circulation. Ginseng, aconite, and/or atractylodes are included in these formulations.

According to Dharmamanda, typical TCM herbal formulas used to treat hypothyroid include:

- Codonopsis and astragalus to tonify qi, and epimedium, curculigo, and cuscata to tonify yang (with cooked rehmannia to balance the yin and yang).
- Psoralea and aconite and cinnamon twig.
- A decoction of aconite, cinnamon bark, ginseng, astragalus, lycium fruit, epimedium, deer antler, psoralea, morinda, salvia, atractylodes, and hoelen. Note that after two months of therapy, 17 of 22 patients experienced their T3, T4, and TSH levels returning to normal.
- Astragalus and codonopsis (30 grams each) to tonify qi, aconite, cinnamon bark, curculigo, and epimedium (9 to 12 grams each) to tonify yang, and lycium fruit plus coix.
• A decoction of licorice (10 grams) and ginseng (8 grams). Note that four out of six patients' basal metabolic rates, T3, and T4 levels returned to normal values after the treatment.

• A combination of cypereus, saussurea, cirandra, curcuma, and bupleurum plus polygonatum, dioscorea, moutan, hoelen, and lycium for qi and blood deficiency patients and Rehmannia Eight Formula for yang deficiency patients. The result? A 29% cure rate.

• A combination of Codonopsis (or ginseng), plus pinellia, hoelen, and licorice to tonify qi and normalize the digestion, and citrus, blue citrus, salvia, and red peony to regulate qi and blood plus the yang tonifying combination of cinnamon twig, deer antler, and epimedium. Result: a 93% cure rate.

Biochemical support for TCM drugs is growing rapidly according to Dharmananda. In animal models with induced hypothyroid conditions, a mixture of either cinnamon bark and aconite or cistanche and epimedium increased T3 and T4 in hypothyroid animals. Khatamines, amphetamine analogues found in the herb Catha edulis, produce an increase in metabolism that is at least partially mediated by thyroid stimulation. Ephedra, contained in the Chinese herb ma-huang, has a similar chemical structure and a similar ability to enhance metabolism. Patients with chronic fatigue symptoms obtain relief by using this herb through the thyroid stimulation. Ginseng has been shown to exert at least part of its effects via the pituitary gland. Since ginseng activities include promotion of DNA, RNA, and protein synthesis, enhancement of energy metabolism, and oxygen utilization, it is possible that the pituitary activity leads to enhanced thyroid activity, finally promoting the metabolic changes. Ginseng is a component of many of the hypothyroid formulas. Licorice also strongly influences hormone balance and may play a role in enhancing metabolism through regulation of the pituitary and adrenal cortex.

In general, in these TCM formulas powdered herbs in pill form are consumed in the amount of 18-30 grams per day, while decoctions are consumed in the amount of about 90-210 grams per day. Duration of therapy typically ranges from six weeks to six months, though some patients require more than a year of treatment to obtain satisfactory resolution of symptoms. Western drugs (thyroxine at 60mg/day) used in conjunction with Chinese herbs help to improve symptoms during the treatment period and appear to enhance the overall effects of the therapy. Acupuncture and moxibustion also improve the effects of Chinese herb therapy.

Conclusion

A crucial element in humans' adaptation to our natural environment over the course of evolution has been production of thyroid hormone, which is essential for metabolism, temperature regulation, and many other vital processes in the body. In modern industrial societies this mechanism has gone awry due to a slew of factors, both cultural and biological, and we no longer have this important tool for adjusting our bodies to seasonal changes. Fortunately, traditional medicine has many useful solutions for improving thyroid function and it is here that we must turn in our quest for the state of optimal wellness that is our evolutionary heritage.

For detailed references, further information or to share feedback please email the author at tim@anthrocode.com.

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