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Assessment of Stress Induced Hair Loss with Biomarkers of Allostatic Load and Benefit from Nutritional Supplements

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Abstract

Background: Hair loss due to stress is a frequent complaint but there is no yardstick to measure stress. Stress increases wear and tear of the cells referred to as the allostatic load which affects the immune, autonomic, neuroendocrine and metabolic functions. Biomarkers of these systems can be evaluated to represent the stress levels. Nutrients, antioxidants, vitamins, minerals, omega 3, amino acids have a role in improving these biomarkers and reducing stress, resulting in hair regrowth

Material and methods: We decided clinical and trichoscopic criteria for stress induced hair loss. Twenty five male and twenty five female patients were evaluated for nine biomarkers including resting pulse, blood pressure, BMI, C reactive protein, cholesterol, triglyceride, LDL, HDL and fasting blood sugar. Patients received a low dose once in three days synergistic nutrient combination program for six months. Trichoscopy, hair density and caliber were checked at a fixed point, at the intersection of midline saggital plane with coronal plane passing through tragus of the ears.

Results: There was 7-14% rise in resting heart rate above 90 beats per minute (mean 99). Blood pressure raised by 10-22% in 63% patients (136/92 mm of Hg). Lipid profile altered by 12-60%, with rise in cholesterol (mean 296 mg/dl), triglycerides (mean 266 mg/dl mg/dl), LDL (mean 192 mg/dl) or fall in HDL (mean 41 mg/dl) was seen in 48% cases. BMI deviated by 10-20% in 40% cases. Fasting blood sugar was raised by 10-30% (mean 132 mg/dl) in 52% cases and raised C reactive protein between 30-70% (mean 4.5), was detected in 56% cases of stress induced hair loss. The raised indices returned to normal or within 5% of normal by the end of 6 months of nutritional therapy. At 6 months there was 18% improvement in hair caliber and 23% improvement in hair density without the use of minoxidil, without finasteride or any hair loss other treatment.

Conclusion: Stress can be measured with neuroendocrine, immune, autonomic and metabolic biomarkers of allostatic load, which respond to nutritional correction and restore hair growth.

Keywords: Hair loss • Allostatic load • Biomarkers • Trichoscopy • Inability to focus

Introduction

We have seen hair loss due to stress. Stress is expressed in mental as well as physical attributes worry, tension, inability to focus, fatigue, headache, overeating or loss of appetite, loss of sleep etc. These feelings and expressions do not have a yardstick to measure and compare. Cortisol and glucocorticoids released in response to stress accelerate the physiological functions for an energy and action response, to face challenges from predators, storms, environment, disease, hunger or unexpected circumstances. The accelerated cell function, caused by mediators of stress response, increases the cellular wear and tear. This cellular degradation is defined as the allostatic load. The allostatic load is reflected through changes in four major systems. The neuroendocrine system, immune system, autonomic system and metabolic functions. Neuroendocrine effects can be measured by levels of cortisol, epinephrine, norepinephrine and DHEAS. Immune effects are measured by raised C reactive protein & WBC counts. Autonomic effects are reflected in resting heart rate, systolic and diastolic blood pressure and the metabolic changes are represented by BMI, waist circumference, waist hip ratio. Metabolic effects are reflected in raised cholesterol, low density lipoprotein, high density lipoprotein, triglycerides, fasting blood sugar & glycosylated haemoglobin. Measuring these biomarkers of allostatic load, can offer a measure of stress.

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Materials and Methods

We measured nine biomarkers of allostatic load in twenty five male and twenty five female patients aged 27 to 40 years. These patients had presented with complaint of hair loss due to stress. Criteria to confirm hair loss due to stress were decided as, absence of family history of hair loss, no signs of hyperandrogenism, shedding of more than 100 hair per day, lack of a defined hair loss pattern, history of stress, patient's recall of hair loss due to stressful event, absence of anisotrichosis, absence of peripilar signs on trichoscopy, absence of inflammation and not more than 5 villus hair per square centimeter. Hair density and caliber were recorded. Trichoscopy was done at a fixed point defined by the intersection of midline sagittal plane with coronal plane connecting the tragus of the ears in each patient.

The biomarkers evaluated were, resting pulse, blood pressure, C reactive protein, Cholesterol, Triglyceride, Low density lipoprotein, High density lipoprotein, Fasting blood sugar, BMI. The biomarkers were compared after six months of low dose once in three days nutritional therapy. Patients received antioxidant, calcium and vitamin D3 on Monday and Thursday. Iron, folic acid, vitamin C and omega 3 on Tuesday and Friday. Essential amino acids, B-complex and biotin on Wednesday and Saturday, followed by a break on Sunday. All doses were as per limits of food supplements.

Observations

There was 6-12% rise in resting heart rate and 8-20% rise of blood pressure in 68% patients. Altered lipid profile with rise in cholesterol, triglycerides, LDL or fall in HDL by 15-55% was seen in 54% cases. BMI deviated by 10-20% in 42%

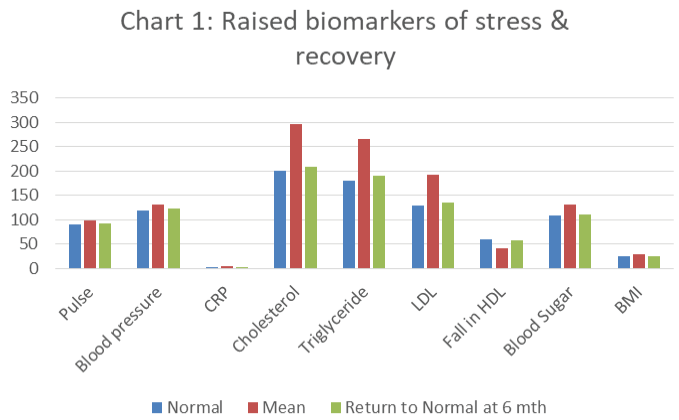

Chart 1. Raised biomarkers of Allostatic load in stress induced hair loss.

cases. Fasting blood sugar was raised by 10-30% in 58% cases and raised C reactive protein between 27-73%, was detected in 62% cases of stress induced hair loss (Chart 1). The raised indices returned to normal or within 5% of normal by the end of 6 months of nutritional therapy. At 6 months there was 18% improvement in hair caliber and 23% improvement in hair density without the use of minoxidil, without finasteride or any hair loss other treatment.

Results and Discussion

Wippert PM, et al. [1] confirmed the reliability of eighteen biomarkers of allostatic load which serve as allostatic indices to measure stress. Botchkarev, concluded that cytokines, neuropeptides and neurotransmitters secreted in response to stress, reduce hair growth and glucocorticoids lead to apoptosis of the hair follicles [2]. Vanaelst has found that, hair cortisol levels in stress are inversely proportional to hair mineral levels of Ca, Mg, Zn levels, with altered Ca:P ratio and chronic stress causes iron, magnesium and nutritional deficiencies [3]. The findings support our observations of stress related hair loss and benefit from nutritional supplements. Arck PC, et al. [4] describe the activation of 'brain-hair follicle axis (BHA)' in stress that causes inhibition of hair keratinocyte proliferation and up-regulation of keratinocyte apoptosis through substance P. Liu N, et al. [5] further established that action of substance P is mediated through ROS (Reactive Oxygen Species). Thus, creating a role for antioxidants and nutrients to counter ROS in stress induced hair loss. Raised biomarkers of oxidative stress were detected in the hair follicles by Prie BE, et al. [6], however they noted that antioxidant capacity of the erythrocytes remained unchanged, indicating a compensatory mechanism.

Stress and allostatic load

Hans Selye, Canadian–Hungarian scientist introduced the concept of stress in health disorders [7]. The first response to stress is secretion of glucocorticoids, so named because they facilitate gluconeogenesis converting lipids and protein to glucose for quick utilization. The aim is to provide energy to the skeletal muscles and brain to flee away from danger and face or fight the event [7]. Glucocorticoids act on the brain cells to promote locomotor action, activate hunger, appetite, which helps in survival and in sports but is of no benefit when we are playing video games, watching television or overeating under stress. Chronic repetitive stress, with lack of activity, no consumption of energy, prevents insulin form regulating glucose uptake and culminates into insulin resistance [7]. Therefore, stress leads to raised fasting blood sugar and raised glycosylated haemoglobin levels.

In response to various stressors, initially the allostatic correction restores physiological function back to normal [7,8]. However, with continuous, repeated, constant exposure the body adapts and resets the functional parameters to higher levels [7,9]. Subjects begin to live with higher heart rate, higher blood pressure, slightly raised blood sugar, marginal dyslipidemias and less than usual wellness. Therefore, we observe raised heart rate, systolic and diastolic blood pressure, altered lipid profile, effect on obesity, BMI and waist hip ratio.

Requirement of nutrients in stress and allostatic state

Stress escalates physiological demand for energy, oxygen utilization and cellular functions which require, enzymes, cofactors, catalysts and micronutrients [10]. However vagal stimulation during stress increases gastric motility, impairs digestion and reduces absorption of nutrients. Vagal stimulation also creates desire for sugar, salt and fatty comfort foods which have poor nutritional content, adding to nutritional imbalance and dyslipidimias [11]. Environmental stress at high altitude increases requirements of vitamin A, C, E, Beta Carotene, copper, selenium, zinc, and manganese [12]. Singh K[13] has published a report on the role of nutrients in stress management.

Nutrients that facilitate reduction of raised cortisol and adrenaline in stress are vitamin C, vitamin B-complex, selenium, magnesium, complex carbohydrates, amino acids tyrosine, tryptophan, thiamine and phenylalanine. Tyrosine is the precursor of noradrenaline while tryptophan is required for secretion of serotonin which is 5-hydroxytryptamin (5-HT) [13]. Serotonin or 5HT receptors in the blood vessels help regulate the blood pressure and reduce stress. Secretion of anti-depressants dopamine and norepinephrine requires phenylalanine and tyrosine which can be metabolized only by vitamin C. Vitamin C also helps in faster recovery from emotional and physical stress [14,15].

Long chain omega 3 derivative Docosahexaenoic Acid (DHA) is a component of the cell membrane of brain cells. DHA is activator of the serotonin secretion genes, working as a natural anti-depressant. Human liver can convert Alpha-linolenic Acid (ALA) to DHA, but this function is compromised during stress [16].

Low levels of vitamin B-complex increase risk of stress, depression, lethargy and irritability. Vitamin B5, pantothenic acid, is called the anti-stress vitamin for its support to the adrenal glands [17]. Vitamin B3, niacin deficiency impairs glucose oxidation and tissue respiration leading to depression, confusion and pellagra.

Mental as well as physical stress causes loss of intracellular magnesium leading to elimination of magnesium through the urine. Stress increases magnesium requirement. Selenium deficiency causes fatigue as it is involved in cellular energy reactions and adrenal function. Vitamin E is required for effective utilization of selenium [18].

Probiotic strains *Lactobacillus acidophilus* and *Lactobaillus rhamnosus* improve the gastrointestinal discomfort, diarrhea, constipation, cramps, bloating associated with stress and are also improve the expression of GABA receptors in the brain [19]. A comprehensive use of vitamin A, C, E, B-complex, Beta Carotene, copper, selenium, zinc, manganese, amino acids, omega 3, EPA, DHA, probiotics can reduce stress, reduce allostatic load and help is hair loss management

Rising allostatic load and declining nutrition

Today the allostatic load is rising with increased exposure to pollution [20], competitive life style, late night work, night life, recreation, lack of sleep [21], exposure to bright screens [22], loss of circadian rhythm [21], endocrine disrupting chemicals [23], lack of exercise, living in closed building environments, exposure to electromagnetic radiation [24] and more. The allostatic load could be countered with good nutrition but over harvesting and hybrid crops have led to loss of nutritive value of the soil leading to 30-40% lower nutritional content in all agricultural produce [25]. Add to this, the increased inclination to smoking [26] and alcohol. Everything sums up to a huge allostatic load which calls for a well-planned, nutritional program to fight stress, restore allostatic balance, deliver health and ensure hair growth. Allostatic load has an equally prominent role in skin ailments [27]. Allostatic load has been found to affect function of the mitochondria and linked to the mechanism of psychosomatic disorders [28,29].

Conclusion

Stress can be measured with immune, autonomic and metabolic biomarkers of allostatic load, which respond to nutritional correction and restore hair growth.

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