THE STATUS OF HAIR MINERALS IN CHRONIC FATIGUE AND DEPRESSED WOMEN

HWEE-SOO JEONG*
Department of Family Medicine and Integrative Medicine, College of Medicine, Dongguk University, Gyeongju, South Korea.
Email: hwesoo@dongguk.ac.kr

ABSTRACT

Objective: Chronic fatigue and depression are common problems in primary care. The status of micronutrients may be related to two conditions. The present study aimed to identify the association of minerals with chronic fatigue and depression.

Methods: We conducted a cross-sectional study using medical records of 97 female patients aged 20–64 years old who visited the integrated medical center of a university hospital in Gyeongju, South Korea, from June 2013 to August 2016. Collected information comprised their scores for the fatigue severity scale, Beck depression inventory, and concentrations of mineral in hair samples.

Results: The subjects were classified into three groups according to their depression and fatigue scores: 21 patients (21.6%) were free of fatigue and depression, 55 (56.8%) experienced fatigue without depression, and 21 (21.6%) experienced fatigue with depression. The potassium (K) concentration in hair significantly decreased in the groups of fatigue or fatigue with depression compared to the group with free of fatigue and depression (p=0.042). The trend of sodium (Na), K concentration, and Na/magnesium (Mg) ratios in hair gradually decreased with fatigue and depression (p for trend=0.027, 0.037, and 0.03).

Conclusion: Chronic fatigue and depression in women are associated with the concentrations of hair minerals, especially Na, K, and Na/Mg ratios.

Keywords: Fatigue, Depression, Sodium, Potassium, Hair.

INTRODUCTION

Fatigue is a commonly seen symptom in primary care. The prevalence of chronic fatigue lasting more than 6 months is 30%, and approximately half of these patients visit a primary care clinic [1]. Chronic fatigue is often caused by mood disorders and, therefore, the use of antidepressants and antianxiety medications is 3 times higher in patients with chronic fatigue as compared to the general population [2]. Furthermore, depression in patients presenting at primary care sites can appear similar to other medical conditions such as chronic pain, fatigue, or gastrointestinal disorders rather than as classic depressive symptoms [3].

Micronutrient deficiency is also considered to be a cause of fatigue. These are involved in cell metabolism, including mitochondrial function. Mitochondrial dysfunction is a cause of the chronic fatigue syndrome [4,5]. A lack of minerals related to oxidative stress, such as magnesium (Mg), is associated with chronic fatigue [6]. Depression is also affected by nutritional status. Depressive patients have low vitamin and minerals intake [7]. Therefore, this study aimed to identify the association of micronutrient such as minerals with chronic fatigue and depression.

METHODS

A retrospective cross-sectional study was performed using the medical records of chronic fatigue patients aged 20–64 years old who visited the integrated medical center of a university hospital in Gyeongju, South Korea, from June 2013 to August 2016. All fatigue patients who visited the integrated medical center had a medical interview were taken laboratory tests and completed the Korean versions (K) of the fatigue severity scale (FSS) and the Beck Depression Inventory (BDI-K) questionnaire to assess their degree of fatigue and depression before treatment. We excluded cases with missing values in the questionnaires or cases that were diagnosed with tuberculosis, liver disease, anemia, thyroid disease, or depression with medication. Male patients were excluded from the study because there were fewer than 10 cases. Finally, 97 female patients were included in the study. The study plan was approved after review by the same hospital’s Institutional Review Board (IRB Number: 110757-2017-10-HR-02-01).

Minerals were evaluated using hair samples. For hair tissue mineral analysis, approximately 150 mg hair samples were obtained by cutting the 1st 3 cm of hair closest to the scalp, at the nape of the neck. Before sampling, the dying and perming of hair were excluded for at least 4 weeks. The samples were sent to the US Trace Elements, Inc. (TEL, Dallas, TX, USA) through Korea TEI. In the US, after washing the hair samples with chemical agents (non-ionic surfactants, deionized water, and acetone) and acid decomposition with nitric acid, the digestive procedure using a high volume and uniform temperature controlled microwave oven (Mars 5 Plus, CEM Corp, NC, USA) was performed. Analysis was performed using inductively coupled plasma mass spectrometry (ICP-MS, a NexION 2000 ICP mass spectrometer, Perkin Elmer Corp., Foster City, CA, USA). Mineral concentrations are reported as µg/g. Data for calcium (Ca), Mg, sodium (Na), potassium (K), copper (Cu), zinc (Zn), manganese (Mn), copper (Cu), zinc (Zn), and Mg were obtained [13,14].

The mean ± standard deviation of the questionnaire scores for all subjects was calculated. All subjects were classified as fatigued or not and depressed or not using the cutoff points described above. Although some of the groups were small in terms of their sample size, parametric
Jeong


In this study, we found that the concentrations of Na and K in hair may be affected by fatigued and depressed women. The hair concentrations of Na and K tended to decrease with fatigue and depression. Na and K are important minerals involved in cell metabolism and blood pressure. The concentration of Na in tissue, not blood decreased in psychological stress. Increased sympathetic response by stress also leads to neural mediated hypotension as a cause of lightheadedness and chronic fatigue. Both low Na concentrations in tissue and hypotension increase serum aldosterone level, which increased Na reabsorption in kidney and urinary K excretion. A deficiency of Na affects mood and depression in animal study, and low dietary salt intake is associated with depression in women. The relationship between the concentration of K in tissue and fatigue was also reported to have an inverse pattern. A decrease in hair K concentration is caused by hyperaldosteronism. Serum aldosterone level increases in the patients with early stage of depression but decreases in severe depression. Decreased serum aldosterone correlated with the score of FSS. Other hair minerals correlated with the score of FSS. None of hair minerals correlated with the score of BDI-K.

The results of the comparison of the hair mineral content among the three groups showed that the Na, K concentrations, and Na/Mg ratios tended to be decreased with fatigue and depression. The hair K concentrations were significantly different 10.86±17.12 µg/g in the fatigue and depression-free group, 5.02±4.59 µg/g in the group of fatigue without depression, and 5.05±4.44 µg/g in the fatigue with depression group and tended to decrease with increasing fatigue and depression scores (p for trend 0.037). The Na concentration in hair was not significantly different among the three groups (18.07±29.76 µg/g, 11.74±11.56 µg/g, and 8.32±6.37 µg/g for the fatigue and depression free, fatigue without depression, and fatigue with depression groups, respectively; p=0.06) but showed a decreasing trend with increasing fatigue and depression scores (p=0.027 for trend). The Na/Mg ratios also tended to decrease with fatigue and depression at 4.93±10.71 µg/g, 1.96±3.20 µg/g, and 1.15±1.78 µg/g in the three groups (p=0.063 and p=0.03 for trend). The concentrations of Ca, Mg, Cu, Zn, and P in hair showed no association with fatigue and depression (Table 2).

**DISCUSSION**

About 70% of the general population believes that vitamin and mineral supplementation can help to maintain health, and some studies have reported that supplementation improves subjective stress, mild psychiatric symptoms, anxiety, and fatigue. In this study, we found that the concentrations of Na and K in hair may be affected by fatigued and depressed women. The hair concentrations of Na and K tended to decrease with fatigue and depression. Na and K are important minerals involved in cell metabolism and blood pressure. The concentration of Na in tissue, not blood decreased in psychological stress. Increased sympathetic response by stress also leads to neural mediated hypotension as a cause of lightheadedness and chronic fatigue. Both low Na concentrations in tissue and hypotension increase serum aldosterone level, which increased Na reabsorption in kidney and urinary K excretion. A deficiency of Na affects mood and depression in animal study, and low dietary salt intake is associated with depression in women. The relationship between the concentration of K in tissue and fatigue was also reported to have an inverse pattern. A decrease in hair K concentration is caused by hyperaldosteronism. Serum aldosterone level increases in the patients with early stage of depression but decreases in severe depression. Decreased serum aldosterone correlated with the score of FSS. Other hair minerals correlated with the score of FSS. None of hair minerals correlated with the score of BDI-K.
causes a decrease in Na concentration in the body and reduces K excretion into the kidney.

Mg is the intracellular cation, a necessary cofactor of many enzymes and regulates the Na, K, and Cl cotransport systems [24]. Stress stimulates the adrenal gland to increase cortisol secretion. The increase in cortisol may facilitate cell metabolism, induce hypomagnesemia in the body, causing a decrease of cortisol secretion in the absence of adequate Mg supplements [25,26]. If chronic stress persists, this vicious cycle may result in functional insufficiency of the adrenal gland. In chronic stress or depression, the tissue concentration of cortisol decreases [27,28]. Hair Mg was inversely correlated with tissue cortisol level [29]. Therefore, the accumulation of Mg in tissues including hair may associate with the decline of cortisol. In this study, hair Mg concentration increased with fatigue and depression, but this increasing tendency was not significant.

In summary, the hair minerals identified in the present study are thought to be associated with hormones of the adrenal gland, and further studies needed to confirm the mechanism of the association adrenal gland with chronic fatigue and depression. In addition, taking herbs such as Passiflora foetida, Bacopa monnieri, Dioscorea oppositifolia, or Alternanthera sessilis which are rich in Na and K can be considered to be an alternative treatment to improve the symptoms of chronic fatigue or depression [30,31].

There are several limitations to this study. First, the mineral state of hair may not reflect that of the whole body and individual information of dietary intake is not reflected in this study. Second, generalization of the results is limited because this was a single-center study and subjects were only the Korean women. Finally, causality cannot be explained by a cross-sectional study design. Nevertheless, the results of this study are meaningful in that fatigue is commonly observed problems in primary care.

CONCLUSION

Chronic fatigue and depression in women affect the concentrations of minerals in the hair; especially Na and K. As fatigue and depression progress, the hair Na and K concentrations tend to decrease.

ACKNOWLEDGMENTS

This study was supported by the Dongguk University Research Fund by 2014.

AUTHORS’ CONTRIBUTION

Jeong HS contributed to all the work of this article (conceived of this study, collected and analyzed the data, and drafted the manuscript).

CONFLICTS OF INTEREST

The author declares that they have no conflicts of interest.

REFERENCES