Ian A. Cyrus, MS, R.Ac., Dipl.Ac., OBT, CH
Practitioner
Acupuncture & Oriental Medicine as Physical Medicine
An Integrative Approach

NUTRITION and MYOFASCIAL PAIN MANAGEMENT

Nutrition of special concern in patients with Myofascial Pain Syndromes are the water-soluble vitamins B1, B6, B12, folic acid, vitamin C, and certain elements: calcium, magnesium, iron, and potassium.

Nutritional deficiencies, especially those involving water-soluble vitamins, are especially common when patients have poor dietary habits, drink excessive amounts of alcohol, or have other chronic diseases. Nearly half of the patients who are treated for chronic myofascial pain require resolution of vitamin inadequacies for lasting relief.

A **Vitamin** is a nutrient that plays an essential role in normal body metabolism as a **coenzyme** to an **apoenzyme**. A **coenzyme** is a diffusible, heat-stable substance of low molecular weight that, when combined with an inactive protein called **apoenzyme**, forms an active compound or complete enzyme called **holoenzyme**.

A need for better vitamin nutrition appears at three levels: vitamin insufficiency, deficiency, and dependence. A vitamin **insufficiency** requires the body to make some degree of metabolic adjustment because the amount of the coenzyme (vitamin) is limited. Myofascial pain syndromes are aggravated by insufficient levels of at least four B-complex vitamins as listed above. Vitamin **deficiency**, on the other hand, is a level of serum (fluids that moistens the surfaces of serous membranes – the watery portion of the blood after coagulation) vitamin, generally below the accepted lower normal range, that is associated with overt clinical diseases such as pellagra or pernicious anemia. Vitamin inadequacy has been known to increase the irritability of Myofascial Trigger Points (MTrPs). Since an energy crisis is a key link in the chain chemical changes that are characteristic of MTrPs, it is to be expected that anything that interferes with the energy supply of muscles will aggravate MTrPs.

A vitamin deficiency may be established by laboratory evidence of abnormally low serum and tissue values for a particular vitamin, by excretion of abnormal metabolic products, by the therapeutic effect of vitamin supplementation, or by a combination of the three.

Vitamin **dependence** is observed in only a few individuals who have a congenital *deficiency* of an enzyme that requires vitamin as a coenzyme. This dependence may require megadosage of the vitamin to compensate for the congenital lack of the enzyme that requires that vitamin. The larger group of people that have a congenital *insufficiency* of the enzyme have a congenital increased need for the corresponding vitamin.

As mentioned earlier, there are *five vitamins of special importance* to myofascial pain syndromes. They are; B1, B6, B12, folic acid, and vitamin C. This does not in any way imply that the others are unimportant for optimal health, only that, based on current knowledge, they are less critical for the relief of MTrP symptoms.

Vitamin B1 (Thiamine Pyrophosphate):

Vitamin B1 is considered to be essential for normal energy production within the cell, and may be a factor in the energy crisis that is a part of the pathophysiology of a MTrP. Further, Vitamin B1 is essential for normal nerve function. This vitamin is also known as the "morale vitamin" due to its beneficial effects on the nervous system and mental attitude. Neuropathy can be a significant factor in the development of MTrP.

Vitamin B1 insufficiency can be detected by the presence of peripheral neuropathy characterized by diminished distal pain and temperature perception in the legs and feet, and by loss of vibration sense. Ankle tendon reflexes may also be lost, but not necessarily so in mild sensory neuropathy. Some Vitamin B1 deficient patients have nocturnal calf cramps, mild edema, constipation, fatigue, and decreased vibratory perception in relation to nerve fiber length. When given Vitamin B1 parenterally, patients may promptly lose several pounds by diuresis with resolution of edema, have softer stools (the body is no longer removing moisture from the bowel to supply the edema), and are relieved of nocturnal cramps.

The abuse of alcohol can lead to signs and symptoms that are a variable composite of three diseases; alcoholism, Vitamin B1 deficiency, and liver dysfunction. In addition to inadequate ingestion of Vitamin B1, a number of factors can increase the need for this vitamin. Vitamin B1 absorption is impaired by alcohol ingestion, liver injury, magesium deficiency, tanins (found in tea), and antacids. Therefore, tea, alkalinizers, and alcohol should not be taken with food. Vitamin B1 is destroyed by *thiaminase,* which is found in a variety of fish, and in bracken fern, which grows in upland pastures where it can pose a hazard to foraging animals. Excretion (loss) of Thiamine is potentiated by diuretics and probably drinking large amounts of water, which also causes diuresis.

Vitamin B1 is available over-the-counter in 10-, 50- and 100mg tablets. It is also available for injection as *Betalin Sc* in 1 ml ampules and in 10 ml and 3o ml vials, at a concentration of 100 mg/ml of thiamine. The therapeutic oral dose usually recommended is 10 mg daily for several weeks, or until evidence of deficiency has disappeared. Increasing this to 50 mg daily will cause no harm and will insure providing for patients with an exceptional need for the vitamin. A B-50 supplement contains 50 mg of thiamine and is an ample daily dose to protect nearly all individuals from thiamine insufficiency and can be taken indefinitely as a safe, inexpensive form of health insurance.

Vitamin B6 (Pyridoxine):

Vitamin B6 is considered important in Myofascial Pain Syndromes (MPS) because of its role in energy metabolism and in nerve function. Patients with chronic myofascial pain are a select group who show a high prevalence of vitamin inadequacies. Many of these patients do well on large doses of vitamin supplements. Vitamin B6 deficiency has been linked to Carpal Tunnel Syndrome. However, its use as a treatment for this condition is controversial and inconclusive. It is also critical for the synthesis of and/or metabolism of nearly all neurotransmitters, including norepinephrine and serotonin, which strongly influences pain perception.

Vitamin B6 affects both physical and mental health. It is beneficial in treating water retention, and is necessary for the production of hydrochloric acid and the absorption of fats and protein. Vitamin B6 also aid in maintaining sodium and potassium balance necessary for optimal muscle function. It is a required nutrient for the nervous system, and is needed for normal brain function and for the synthesis of the nucleic acids RNA and DNA, which contain the genetic instructions for normal cellular growth.

Vitamin B6 plays an important role in cancer immunity and aids in the prevention of arteriosclerosis. It inhibits the formation of a toxic chemical called homocysteine, which attacks the heart muscle and allows the deposition of cholesterol around the heart muscle.

Vitamin B6 requirement rises roughly in proportion to the increase in protien intake and with age. The National Research Council (Great Britain) RDA for vitamin B6 is 1.6 mg for adult females and 1.4 mg for adult males, whereas the 1989 National Academy of Sciences (USA) RDA remain at the previous level of 1.4 mg for adult females and 2.0 mg for adult males. The current RDA of 2.0 per day may be more than is necessary to maintain the minimum health of a normal adult (with no exceptional needs). Vitamin B6 is available over-the-counter in 10-, 25- and 50 mg tablets, and in larger amounts by prescription. Parenteral pyridoxine hydrochloride is available in vials of 10 and 30 ml in a concentration of 100 mg/ml. A single intra-muscular injection of pyridoxine effectively raises the serum level of the vitamin. Again, a B-50 vitamin supplement contains 50 mg of pyridoxine and is an ample dose to protect nearly all individuals from pyridoxine insufficiency. This vitamin can be taken indefinitely and is relative inexpensive.

Vitamin B6 deficiency has been linked to excessive alcohol consumption, oral contraceptives, and use of corticosteriods. The need for vitamin B6 is increased in hyperthyroid and both dialyzed and undialyzed uremic patients. Also, the requirement for vitamin B6 in pregnant and lactating women is markedly increased.

Vitamin B12 (Cobalamin) and Folic Acid:

Cobalamin and folic acid are considered together because their metabolism and function are intimately linked. These two essential enzyme co-enzyme cofactors (essential because they must be supplied by outside sources as they cannot be synthesized by humans) are required DNA synthesis in erythropoiesis and in rapidly dividing cells such as those in the gastrointestinal tract, and for fatty acid synthesis that is critical for nerve myelin formation.

Role in Myofascial Pain Syndromes. Vitamin B12 and folic acid insufficiency and deficiency states can be seen in chronic myofascial pain syndromes (MPS). An explanation of why deficiency of these two vitamins would aggravate the painfulness of myofascial trigger points (MTrPs) is not clear and needs further investigative inquiry. Lack of vitamin B12 and folic acid reduces blood cell production. The blood cells transport oxygen to the muscles, oxygen that is essential for their energy metabolism. A severe local energy crisis exists in the region of the dysfunctional endplates of MTrPs. The crisis releases substances substances which sensitize local pain receptors, causing pain and local tenderness. It is now known that Vitamin B12 deficiency may be associated with peripheral neuropathy. Neuropathy is associated with increased MTrP irritability. However, the mechanism with respect to dysfunction in MPS is not clear.

Patients with acute lumbar or cervical radiculopathy can present with acute MPS before there is any clinical sign of radiculopathy. In some cases of MPS can result from nerve injury resulting, for example, from post lumbar-laminectomy. Metabloic nerve dysfunction resulting injury can also lead to the formation or the persistence MTrP's.

Functions of Vitamin B12. Vitamin B12 serves numerous essential metabolic functions that includes but not limited to the following:

1. Deoxyribonucleic Acid (DNA) synthesis
2. Regeneration of intrinsic folates which is also critical to the syntheseis of DNA
3. The transport of Folate to, and its storage in cells
4. Fat and Carbohydrate metabolism
5. Protein metabolism
6. Reduction of Sulf-hydryl groups

Since Vitamin B12 and Folic Acid are required for the synthesis of DNA, both are necessary for normal growth and tissue repair. Deficiency of Folic Acid impairs the synthesis of DNA causing megaloblastosis in all duplicating cells of the body. This is most commonly seen in bone marrow cells.

Folic Acid is critical to the development of the brain and essential for its normal functioning after birth. Insufficiency of Folic Acid is the most common vitamin inadequacy and among those inadequacies like to perpetuate MTrps. It should be noted that symptoms described by patients with myofascial pain who have marginally low

serum Folate levels are similar to, but less intense than, many symptoms reported by patients with obvious neurologic disorders responsive to Folic Acid therapy Increased susceptability to MTrPs are commonly observed in patients with low Folic Acid levels. They tire easily, sleep poorly, and feel discouraged and depressed. These patients also feel cold and have a reduced basal temperature, as do patients with thyroid hypofunction; their symptoms are often relieved by multivitamin therapy including Folic Acid. Deficiency of Vitamin B12 and Folic Acid should be identified in the management of MTrPs.

Vitamin C (Ascorbic Acid):

This vitamin is of clinical importance to the muscles because it can prevent most post-exercise soreness or stiffness; it also corrects the increase in capillary fragility associated with ascorbic acid which significantly complicates MTrP needling.

Ascorbic acid is involved in a vast array of essential body functions, including **collagen** synthesis, degradation of **amino acids,** and the synthesis of two **neurotransmitters** (epinephrine and serotonin).

Collagen constitutes nearly one quarter of the protein in body tissues. The strong reducing action of ascorbic acid is needed for hydroxylation of the amino acids lysine and praline to form the protocollagen molecule. This function may be assisted by ascorbic acid inhibition of hyaluronidase.

Ascorbic acid has been shown to be important in wound (pressure sores) healing, bruising (capillary wall fragility), amino acid degradation, neurotransmitter synthesis, stress response, toxic substance protection, scurvy, and immunity. According to Travell, 1982, ascorbic acid does influence the immune system, but its role is unclear. Travell wrote that ascorbic acid helps to alleviate bouts of diarrhea due to food allergy, and to decrease toxicity and MTrP activity caused by chronic infection.

The recommended dose of ascorbic acid is 60 mg/day which will prevent scurvy. A physiological dose of as much as 500 mg/day ensures a normal metabolic pool of ascorbic acid to meet emergency demands, or a mega dose of 2-8 g/day, which may have nonscorbutic effects such as protection from colds and cancer. The daily dose necessary to ensure steady-state saturation levels in the tissues is about 450 mg/day and is best taken in two or three doses per day. Oral intake of beyond tissue saturation should not be necessary, but the optimal intake required depends on highly variable stress factors. When one is sick there is a greater tolerance for Vitamin C, than when one is in good health. This suggests that megadoses are unnecessary when one is well, yet may be therapeutic when in poor health.

Ascorbic acid can interact with other vitamins. It can interact with folic acid as it is important in its absorption. Absorption of folic acid can increase with oral administration of ascorbic acid in the presence of liver disease. Dose of more than 500 mg of ascorbic acid can lead to lower serum levels of Vitamin B-12. Ascorbic acid can

also lead to increased absorption of some metallic ions such as iron which may be desirable and mercury which may undesirable. Ascorbic acid increases the amount of warfarin (coumadin, a widely prescribed blood thinner) required to maintain the same therapeutic effect on blood clotting, i.e. it lowers prothrombin time in patients on warfarin. Large doses of ascorbic acid can cause loose stools that can often be mis-diagnosed as spastic colon and a non-specific urethritis. The daily requirement of ascorbic acid may increase 3 to 10 fold, requiring daily amounts of up 500 mg three times per day. Cigarette smoking decreases serum levels of ascorbic acid substantially requiring therapeutic supplementation.

Dietary Minerals and Trace Elements (Calcium, Magnesium, Potassium, Iron):

Several minerals, especially iron, calcium, potassium, and Magnesium, are needed for normal muscle function. Clinical observations indicate that deficiency of the aforementioned minerals tend to increase irritability of MTrP.

Iron is an essential component of the hemoglobin and myoglobin molecules, which transport oxygen to and within the muscle fibers to meet energy demands. Another role of iron is the regulation of hormonal functions like thyroid hormone that again plays a critical role in energy metabolism and clinically important in chronic myofascial pain syndromes. Finally, there is the role of iron in the body's temperature regulation that may affect body temperature and perception of coldness that is seen in persons with myofascial pain.

***Requirements*:** Iron are determined by daily iron losses, which are about 0.8-1.0 mg daily, except in menstruating women whose losses are 1.4-2.4 mg/day. About 10% of dietary is absorbed, with a ceiling of 4-5 mg/day in anemic individuals. Reduced iron stores must be replenished in iron deficient persons, although iron supplements may be difficult for some persons to take because gastric irritation, constipation, or diarrhea that develops in almost half of those taking them.

Sources: Dietary iron is present as easily absorbed heme iron or as poorly absorbed nonheme iron. Nonheme iron absorption is enhanced by absorption promoters, the most potent being ascorbic acid or vitamin C. Inhibitors of nonheme iron absorption include phytates (Phytic acids ound in cereal grains, nuts, and legumes) and calcium. Calcium in milk, cheese, or as a supplement can decrease nonheme iron absorption by 50% and can also significantly reduce absorption of heme iron. Calcium supplements should not be taken with iron supplements. Phytic acids chelate or leach heavy metals and are potent inhibitors of iron absorption, but the presence of phytic acids in nuts and soy are offset by the high iron content of these foods. The strong iron absorption promoter ascorbic acid can overcome the effect of dietary inhibitors significantly.

Causes of Insufficiency and Deficiency:

1. Menstruation
2. Possible carcinoma in men
3. Gastric irritation with microscopic blood loss in both men and women who take NSAIDS (Non-Steroidal Anti-Inflammatory Drugs)
4. Pernicious Anemia
5. Moderate exercise has been shown to reduce iron stores as measured by serum levels. Other the other hand, moderate exercise also increases iron absorption

Determining Iron Insufficiency and/or Deficiency:

Measure iron stores by the serum ferritin test. Levels of 20 ng/ml or less signify iron store depletion. Levels of 30-50 ng/ml may indicate a need for replacement of iron stores.

Treatment of Iron Insufficiency and/or Deficiency:

Treat iron depletion at ferritin levels of 30 ng/ml or lower, even levels of up to 40 ng/ml to prevent iron depletion.

150 mg of iron (equivalent of elemental iron) are taken twice daily if tolerated, or once daily if necessitated due to constipation or gastric irritation. Iron can be taken with folic acid (1 mg) to lessen the symptom of gastric irritation.

Iron supplements are not taken with calcium supplements or dairy products. However, taking them with vitamin C helps absorption. Iron supplements are available with stool softeners and in different formulations. Therefore, finding one that works for you is possible.

Once serum ferritin levels reaches 30-40 ng/ml, a small dietary supplement of 12-15 mg, commonly found in most multivitamin with mineral preparations is enough to maintain tissue iron stores.

***Warning*:** Iron supplementation should “always” be monitored to avoid iron storage and *hemochromatosis*. Checking serum level every three months are adequate to monitor supplementation at higher doses, and every six months until stable for lower dose maintenance. Iron supplements should be given unless iron insufficiency is established through the measurement of serum ferritin levels because iron overload can lead to hemochromatosis, eschemic heart disease and poorer outcome after stroke.

Calcium:

Optimum Calcium Intake:

Young Adults and adolescents:	1200 – 1500 mg/day
Women (ages 25 – 50):	1000 mg/day
Women (postmenopausal not on Estrogen Replacement):	1000 mg/day
Women (postmenopausal on Estrogen Replacement):	1500 mg/day
Adult males:	1000 mg/day
Over 65 (all persons):	1500 mg/day

*Calcium intakes up to 2500 mg/day do not result in hypercalcemia in normal persons.

There are no studies to link abnormalities in calcium metabolism to myofascial pain syndromes (MPS). However, there is an anecdotal link suggesting that disturbances in serum calcium level is extremely uncommon in patient with MPS. However, calcium is of great interest in MPS because of it's role in muscle contraction and in modulating pain responses.

Potassium:

***Recommended daily allowance*:** < (50 mEq)

- more is needed if there are unusual losses

***Normal concentration of serum potassium*:** 3.5 – 5.0 mEq/L

Total body potassium is low in hypothyroidism and high in hyperthyroidism. Clinical observations have shown that hypokalemia aggravates myofascial trigger points (MTrPs). Potassium deficiency disturbs the function of smooth muscle (cardiac muscle) as evidenced by electro-cardiogram.

Potassium rich foods:

Fruits (especially bananas and citrus fruits)
Potatoes
Green leafy vegetables
Wheat germ
Beans
Lentils
Nuts
Dates
Prunes

***Dietary considerations*:**

In general, a healthy diet should be high in potassium and low in sodium. However, this is not true for those with adrenal insufficiency.

A diet high in fat refined sugar, over-salted food, and low in potassium, can lead to potassium deficiency. Diarrhea, laxatives, and certain diuretics increases potassium loss.

Magnesium:

Studies thus have failed to show a link between low magnesium and the perpetuation of myofascial pain syndromes (MPS). However, there is some anecdotal evidence that suggest that erythrocyte magnesium levels are significantly lower in patients with myofascial pain.

Magnesium however, is critical to many cellular functions, including energy production, protein formation, and cellular replication. Magnesium participates in more than 300 enzymatic reactions in the body, in particular those processes involved in energy production, i.e., production of ATP (Adenosine Tri-Phosphate). Magnesium is also required for the activation of the sodium-potassium pump that pumps sodium out of, and potassium into the cells. Therefore, magnesium deficiency results in decreased intracellular potassium. As a result of lower magnesium and potassium within the cell, cell function is greatly disrupted.

Magnesium as been referred to as “nature’s calcium channel-blocker”

Future studies of magnesium with respect to MPS need to be conducted.

***Recommended daily intake (RDI)*:**

Adults: 4.5 mg/kg or about 250-350/day