

## Application of Herbs in Sport (Part 1)

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Herbs have been used for thousands of years. And they've been used especially for traumatic injuries. This makes it applicable for the sports medicine doctor. They've been used for sports injuries to reduce inflammation and also promote tissue healing. Another use of herbs is to enhance athletic performance. And they can potentially do this by improving oxygen utilization. They may also be used for the prevention of delayed onset muscle soreness after an athletic event.

Another really important aspect of herbs is that they can be used during the season to up regulate the immune function to prevent illness. There are three main categories of herbs that will be discussed in this presentation. Adaptogens, oral anti-inflammatories, and topical anti-inflammatories. Adaptogens help us to cope with physical and mental stress. Adaptogens we'll discuss includes Siberian ginseng, rhodiola, and ashwagandha.


The oral anti-inflammatories, which are ingested, help to suppress cellular and tissue damage as well as promote tissue healing. The oral anti-inflammatories we'll discuss are tart cherry, turmeric, bromelain, quercetin, and Bowellia. We'll also be discussing topical anti-inflammatories.

The topical anti-inflammatories fall into two categories. Herbs that are strictly anti-inflammatory, and herbs that are counterirritants. Anti-inflammatory herbs suppress cellular and tissue damage, and the example of that is Arnica. Counter irritants causing mild irritation on the skin surface which produces prostaglandins, substance P, and some redness. And basically, it will desensitize the tissue, ultimately resulting in less pain.

The examples of counter-irritants are cayenne pepper and peppermint. Siberian ginseng has been used to enhance athletic performance. It's basically used to prevent and treat fatigue. In fact, Russian cosmonauts in the 1970s used Siberian ginseng to increase their energy and help them to adapt to space. Part of the reason that Siberian ginseng is believed to do this, is because it may act as a hormone receptor binder.

It's believed to interact with the receptors of mineralocorticoids, glucocorticoids, progestin, and estrogen. And basically, it's going to provide a positive or negative feedback to help to regulate those levels of those different hormones. It also has a similar effect on cortisol. And helping to regulate cortisol can be beneficial, because it's been found that higher levels of cortisol are associated with fatigue. Cortisol is also associated with the regulation of glucose metabolism.

And so influencing cortisol could possibly have an effect on aerobic metabolism. It can also help to ensure that there's enough glucose available for uptake into the tissues during exercise and physical activity. The other aspect of Siberian ginseng is it's been shown to increase nitric oxide synthesis, which vasodilates or opens up the blood vessels to deliver more oxygen to the tissues.



And it also has effects as a chemical or methyl transference inhibitor, which helps prevent the degradation of epinephrine or norepinephrine which can help with the activation of sympathetic activity and increasing blood flow to the tissues. Here's a study showing the effects of Siberian ginseng on exercise. In this study, athletes were split into two groups. One group received 800 milligrams of Siberian ginseng, the other group received a placebo for eight weeks.

They underwent cycling trials, and it was found that the Siberian ginseng group had a 12% increase in peak oxygen volume indicating better oxygen utilization. It was also found in the treatment group that they could cycle longer until they became exhausted. And it was a 23% increase, on average. The investigators tried to explain this by looking at the levels of free fatty acids and plasma glucose.

What they found was that free fatty acids were elevated and glucose was lower. This indicates a better oxygen utilization and also a better fatty acid utilization because of increased mobilization of fats from the tissues to be used by the muscles for energy.


So they proposed that this basically enhanced aerobic metabolism and beta oxidation, which is the breakdown of fatty acids and helped to preserve glycogen in the liver, so it was not used so it could be there in case it was needed. Here is a study using Siberian ginseng measuring the levels of corticosterone, looking at the concentration of natural killer cells and fatigue.

In this study, they gave rats five different extracts of Siberian ginseng and then had them perform forced swimming under stress until fatigued. What they found is that three of the five Siberian ginseng extracts helped to prolong the amount of time the rats were able to swim under stress. In addition, they found that natural killer cells were increased, indicating that the immune system was up regulated.

And they found that corticosteroids levels were lower. Basically, this indicates that Siberian ginseng boosts the immune function to help prevent infection. And it also helped to reduce corticosterone levels associated with fatigue. The higher levels of corticosterone, the more stress an individual is under, or in this case, an animal, and the more likely they are to be exhausted sooner.

Siberian ginseng is considered generally safe. However, at high dosages, it could possibly cause side effects like palpitations, mastalgia, anxiety, irritability, and insomnia. It's contraindicated with hypertension, and it should be noted that you need to take caution with antihypertensive medications because Siberian ginseng could reduce the effectiveness.

Now, it is only contraindicated with severe hypertension, that is systolic blood pressure over 180 or diastolic blood pressure over 90 millimeters of mercury. If someone had a past heart attack or stroke, they probably shouldn't use Siberian ginseng. It could also interfere with medications for depression, and for that reason is contraindicated. And it could make anxiety, schizophrenia, and insomnia worse.



To prevent insomnia, it's recommended to use the dose before 5 PM. There's several different ways to use Siberian ginseng. It can be in the capsular form, at a dosage of 150 to 500 milligrams upwards of three times a day. You can use the raw herb or the dried herb at a dose of 1 to 4 grams. You typically use that once a day. You can use a tincture in a 1:5 ratio. And you can use 50 to 20 drops, typically that's used once a day as well.

The treatment period for Siberian ginseng is six weeks. And then at least three weeks off. Then you can start back up with six weeks and a three week off. And you continue that cycle. Siberian ginseng can be combined with other adaptogens like rhodiola and schisandra. However, you want to be careful with using it with other stimulants like caffeine, because that can cause adverse effects.

Historically, rhodiola has been used in Eastern Europe, Scandinavia, and Asia to increase physical strength and endurance. In fact, the Vikings used to use rhodiola to increase their strength before they would go and pillage a village. The mechanism of action of rhodiola is similar to Siberian ginseng. Both of them help to prevent depletion of adrenal catecholamines. Rhodiola does this by acting as a monoamine oxidase inhibitor and catechol-o-methyltransferase inhibitor.


Both of those enzymes help to increase dopamine, epinephrine, and norepinephrine. It's also been shown to act as a reducing agent for cortisol. As discussed previously, reducing cortisol helps reduce fatigue. Lastly, rhodiola has been shown to be beneficial to increase mitochondrial activity and enhance ATP production which enhances energy utilization.

In this study, rats were given 25, 50, or 100 milligrams per kilogram extracts of rhodiola or placebo for four weeks and then they were subjected to swimming until exhaustion. The parameters that were measured were the production of reactive oxygen species in the mitochondria, exercise tolerance, and liver glycogen levels. The investigators found that overall lipid peroxidation in the mitochondria was reduced.

And they found that the mitochondria had increased levels of superoxide dismutase, glutathione peroxidase, and catalase indicating they had better antioxidant activity which enhanced mitochondrial function and ATP production which improved exercise tolerance.

This was also found to be beneficial for helping with preserving liver glycogen levels, indicating that overall aerobic metabolism was enhanced, so the rats that receive the rhodiola were in aerobic metabolism for longer, and thus able to exercise for a longer period. Another study showing the benefits of rhodiola was done with 14 trained athletes. The athletes were given rhodiola or placebo for four weeks.

The investigators measured the athletes' endurance using a cardiopulmonary exhaustion test. The treatment group was found to have lower levels of blood lactate and creatinine kinase, demonstrating an improvement in aerobic. Metabolism. This was shown to help to prevent delayed onset muscle soreness by reducing lactic acid production.



Another study supported this by showing that pulmonary ventilation and exercise capacity were increased when supplementing with rhodiola. This indicates that rhodiola kept the individuals in aerobic metabolism for longer, again showing that it helped to promote oxygen utilization in the tissues. Rhodiola is considered to be generally safe. There are relatively few side effects associated with it. However, difficulty sleeping, vivid dreams, or irritability may possibly occur.

It is contraindicated with individuals that have hyperactivity of the sympathetic nervous system in disorders such as anxiety, bipolar disorder, or insomnia. The typical dosage of rhodiola is 50 to 200 milligrams once a day. It's recommended to take rhodiola in the morning to prevent interference with sleep and cause insomnia.

Rhodiola interacts with other monoamine oxidase inhibitors. And so caution should be taken if the individuals are already using a monoamine oxidase inhibitor to prevent toxicity. Ashwagandha is an adaptogenic agent just like the previous herbs we've been discussing. It's also known as Indian ginseng, and it's been used in Ayurvedic medicine to improve both physical and mental health as well as increased longevity.


Ashwagandha helps to regulate cortisol as well as gamma-Aminobutyric acid, and the regulation of both of these substances can help prevent fatigue. Ashwagandha has also been shown to increase hematopoiesis as well as hemoglobin which can help with the blood's ability to carry oxygen to the tissues and keep people in aerobic glycolysis. A study did demonstrate these effects using young athletes taking 500 milligrams of Ashwagandha for eight weeks.

At the end of the study, the athletes had an increase in speed, strength, and VO2 max. The increase in VO2 max indicated better oxygen utilization in the tissues. And it was also shown that at the end of the study, the athletes had better muscle coordination. Animal studies have shown similar results. Another way that Ashwagandha may improve energy is by enhancing glucose uptake into the tissues, specifically the muscular tissue.

Ashwagandha has also increased thyroxine levels. Increasing thyroxine may increase muscle protein transcription and improve the bulk of the individual. A study was shown to do this. And basically, in this study, 300 milligrams of the extract was used for eight weeks. And at the end of the study, the individuals did have an increase in muscle bulk. Another benefit of Ashwagandha is that it can prevent stress induced illnesses that occur, especially in the later parts of the season.

It can accomplish this by regulating cortisol. Cortisol is an immunosuppressant. The higher the levels, the more likely the immune system is to be down. So reducing cortisol helps to increase immune function. Ashwagandha also helps to boost immune function by increasing cell mediated immunity. And does this by increasing the separation of white blood cells, especially neutrophils, lymphocytes, and macrophages.

The mechanism that it does this may be by stimulating the release of interleukin 2 and interferon-gamma. Interleukin 2 promotes the proliferation of certain types of T cells, and interferon gamma increases the activity of macrophages and phagocytes. An additional benefit is that Ashwagandha has many antimicrobial effects against a wide range of bacteria and viruses.



Ashwagandha is also an excellent anti-inflammatory and antioxidant agent. It produces its anti-inflammatory effects in many different ways. One of them is reducing Nuclear Factor Kappa B expression. Nuclear Factor Kappa B is a transcription factor associated with the arachidonic acid cascade and eicosanoids. These are all pro inflammatory components.

In one study, it was shown to be chondroprotective. Ashwagandha was exposed to human osteoarthritis joint cartilage, and it was shown to reduce collagenase activity. collagenase is typically higher in tissues with chronic inflammation. In another study, 500 and 1,000 milligrams per kilogram of Ashwagandha were given to animals. And it was found to be beneficial to reduce inflammation and have an analgesic effect.

An additional study showed that Ashwagandha helped prevent the depletion of antioxidants in bone collagen that was inflamed. It's been shown in many studies to have antioxidant activity. And it's been shown to increase antioxidant enzymes, such as glutathione-s-transferase and peroxidase, catalase, and super oxidase mutase. Increasing antioxidant activity is very important, especially for tissue healing.


The reason being that when there is tissue damage, DNA needs to be broken down. When DNA is broken down during purine degradation, xanthine oxidize, which is an enzyme that is active along the pathway of the breakdown of purines in DNA, has been found to produce hydrogen peroxide.

So hydrogen peroxide can damage tissues and interfere with tissue healing. Therefore, using some kind of herb that increases antioxidant activity could help promote healing by suppressing xanthine oxidase activity. Ashwagandha is considered to be generally safe and has a high therapeutic index. This is demonstrated by the dosages it can be used at. It's either used at 20 to 50 milliliters per week of a tincture, or 500 to 6,000 milligrams per day of a capsule.

The main side effects are gastrointestinal upset, diarrhea, and vomiting. And these typically occur at high dosages. There was one case of thyrotoxicosis that was reported. However, this was believed to be due to an allergic reaction and appears to be an isolated incident. Abnormalities of the kidney and liver have also been reported. Yet other studies have shown that Ashwagandha is possibly correlated with natural protection and hepatoprotection.

And so it's unlikely to cause damage to the kidney or liver. Ashwagandha is contraindicated for the use in patients with peptic ulcers and autoimmune conditions, because those can be potentially exacerbated. In fact, Ashwagandha has been shown to be beneficial to help to reduce toxic effects of drugs. However, there may be some interactions such as with sedatives, stimulants, thyroid drugs, Digoxin, and immunosuppressants.

Ashwagandha could possibly have synergistic effects with thyroid medications as it increases thyroxine levels. And so, there's an increased risk of toxicity. It's also been shown to reduce the levels of Digoxin, reducing its effectiveness. And it could also reduce the effectiveness of immunosuppressant drugs. So it's not recommended to use Ashwagandha with those agents.



Tart cherry was cultivated in North America by Native Americans, and it was used for antioxidant, anti spasmotic, and anti-inflammatory activities. The anti-inflammatory and antioxidant effects are the primary reason that tart cherries can be beneficial for sports related injuries and helping to prevent delayed onset muscle soreness. Tart cherry has been shown to inhibit interleukin 6 release, preventing the activation of C reactive protein, which is associated with chronic diseases.

It has also been shown to act as a cyclooxygenase inhibitor, suppressing the production of thromboxane compounds and prostaglandins correlated with the inflammatory cascade. In a randomized double blind crossover study performed, the anti-inflammatory effects of tart cherry juice were evaluated for the treatment of 58 patients with osteoarthritis. Each patient was instructed to drink two eight ounce bottles of tart cherry juice or placebo per day for six weeks.

The Western Ontario McMaster osteoarthritis index was used to determine the level of pain and stiffness as well as physical function. Walking times pre and post treatment were also documented. It was found that after the six week period, that the degree of pain and stiffness and physical function had significantly improved compared to placebo. However, there was no significant improvement in the walking times pre and post treatment.


As an antioxidant, tart cherry juice is noted as a potent reducing agent of hydroxyl-peroxynitrate and superoxide radicals. The antioxidant activity is very beneficial for muscular injury as previously explained, but is also important during physical activity.

During physical activity, the mitochondria is generating adenosine tri phosphate at a rapid rate. An unfortunate byproduct of ATP production is the creation of superoxide radicals from auto oxidation reactions and the leakage of electrons from the electron transport chain. Therefore, oxidative stress is elevated when exercising, increasing the risk of oxidation to the tissues. Increasing oxidative stress raises cortisol during physical activity, which is possibly correlated with fatigue.

In a randomized study, the aptitude of tart cherry juice was tested in 54 healthy male and female athletes. In this experiment, participants consumed 355 milliliters of tart cherry juice or placebo twice a day for a week prior to a marathon. The level of pain was then assessed before and after the marathon via a 100 point visual analog scale.

Both groups reported increased pain after the marathon was completed. However, the tart cherry juice group reported a significantly lower increase in pain compared to placebo at 12 plus or minus 18, compared to 37 plus or minus 20. Tart cherry juice is very safe. The only negative effect associated with it is some GI upset, and that's transient. There are no known contraindications for the administration of tart cherry juice.

Tart cherry juice does have a sedative effect and can be synergistic with other sedatives. Tart cherry juice should not be consumed directly before a competition. Instead, the way it should be utilized is by drinking it one week prior to the competition or throughout the season.



The dosage of tart cherry juice is two ounces of the juice mixed with six or eight ounces of water in a cup one hour before bed.

Turmeric is a powerful antioxidant and anti-inflammatory agent. It is capable of inhibiting a nuclear factor kappa B, which was previously discussed as being a transcription factor for the upregulation of pro inflammatory ecosystems. It can also act directly on phospholipase A, COX-2 activity, and lipoxygenase. Reducing the effects of these enzymes helps reduce the inflammatory cascade and reduces the production of eicosanoids.

Turmeric is very beneficial for helping to reduce the production of pro inflammatory mediators such as C-reactive protein, tumor necrosis factor alpha, and interleukin 1, as well as suppressing collagenase, elastase, and hyaluronidase activity associated with chronic inflammation. During acute inflammation, it has been shown to reduce monocyte chemo attractant protein-1 which can help to reduce swelling after tissue injury.


As an antioxidant, turmeric has been shown to directly reduce free radicals. It has also been shown to increase glutathione peroxidase, glutathione reductase, and catalase activity. Turmeric is capable of inhibiting xanthine oxidase activity, preventing the production of hydrogen peroxide. As we discussed earlier, it could potentially damage the tissues and slow tissue healing. Studies have demonstrated that it is 10 times more potent than vitamin C as an antioxidant.

And Vitamin C is considered to be the most powerful water soluble antioxidant. Another consideration is the fact that turmeric has been shown in studies to enhance mitochondrial function by increasing the efficacy of the enzymes and complexes involved with tricarboxylic acid cycle and the electron transport chain, optimizing ATP production and thus optimizing energy.

A randomized, open end blinded study was performed using turmeric for 80 patients with knee osteoarthritis. The patients were administered either 30 milligrams of turmeric, or 25 milligrams of diclofenac sodium three times a day. Diclofenac sodium is a non steroidal anti-inflammatory agent. Joint aspiration was performed to evaluate the effects of agents on COX-2 activity.

Both groups were shown to significantly reduce COX activity by 1.84 plus or minus 0.37, compared to 1.79 plus or minus 0.38. The turmeric group had a value of 1.84, plus or minus 0.37, and was considered to be superior. Another study compared the efficacy and safety of 800 milligrams of ibuprofen versus 2 grams of turmeric once a day for six weeks in 107 patients with osteoarthritis of the knee and a pain score greater than or equal to 5.

Upon completion of the study, both groups significantly improved from baseline. However, no significant difference in efficacy between the two groups was noted. In the turmeric group, 33.3% of patients experienced adverse effects compared to 44.2% in the ibuprofen group. Turmeric is considered to be generally safe. The most common side effect is GI upset, and that's transient. Mild hair loss from oral use is not common.



However, topical use of turmeric could possibly cause the hair on the skin to fall out. There was a single case of dermatitis and anaphylaxis that was reported with the use of turmeric. However, this was considered to be an isolated incident. Turmeric is contraindicated with biliary colic, because it is a cholagogue. A cholagogue promotes the release of bile from the gallbladder and could possibly increase the risk of a stone getting caught in the duct.

Turmeric is also contraindicated during pregnancy, because it's a menagogue, which increases blood flow to the uterus, and could potentially cause a miscarriage. The dosage of turmeric is 1.5 to 3 grams. That can be added to boiling water and used as a tea, or it can be consumed in the capsular form. 10 to 15 drops of the liquid tincture can also be used upwards of three times a day.

Turmeric can be administered with ginger, *Bowellia*, or ashwagandha to enhance its anti-inflammatory and antioxidant effects. Turmeric also produces synergistic effects with anticoagulants and can increase the risk of bleeding. Therefore, caution should be taken with co-administration. It should also be noted that turmeric is not well absorbed.

And so you may see capsules being used in conjunction with black pepper to enhance absorption.