DMSO (Dimethylsulfoxide)

DMSO (dimethyl sulfoxide) is a colorless, slightly oily liquid that is primarily used as an industrial solvent.

- Iron absorption is reduced by the host as a defence mechanism during an infection.
- Iron levels are elevated in the inflamed mucosa.
- Oral iron supplements anecdotally exacerbate inflammatory bowel disease
- Mucosal iron may enhance hydroxyl ion production via Fenton chemistry.
- During inflammation, the superoxide anion (O-2) and hydrogen peroxide (H2O2) are produced by stimulated polymorphonuclear leukocytes and macrophages. The toxic effects of these reactive oxygen intermediates increase when traces of iron are present, because iron catalyzes the formation of the hydroxyl radical (OH.).
- Iron release from ferritin depends on O-2

DMSO

- Dimethylsulfoxide (DMSO) induces hemoglobin synthesis and erythroid differentiation of Friend erythroleukemia cells in vitro. Induction is accompanied by increased transferrin-binding activity which is necessary for the cellular acquisition of iron from transferrin for hemoglobin synthesis.
- dimethylsulfoxide (DMSO) and deferoxamine (DFX), the latter being an iron chelator which prevents HO formation by blocking the Fenton reaction, were found to inhibit TNF-alpha production in LPS-stimulated human PBMC

Striking Resemblances:

- Steroids (Prednisolon) inhibit the secretion of free radicals by Polymorphonuclear neutrophils

- 5-ASA (Asacol) exhibit superoxide and hydroxyl-radical scavenger properties.

The Inflammation Mechanism

During infection, the body makes considerable metabolic adjustment in order to *make iron unavailable to microorganisms*.

As a result of infection, there is:

1. Decreased intestinal absorption of iron from the diet
2. Decrease of iron in the plasma and an increase in iron in storage as ferritin
3. Increased synthesis of the human iron-binding proteins (iron chelators), lactoferrin and transferrin which trap iron for use by human cells while making it unavailable to most microbes.
4. Coupled with the febrile response, decreased ability of bacteria to synthesize their own iron chelators called siderophores.
5. Prior stationing of lactoferrin at common sites of microbial invasion such as in the mucous of mucous membranes, and the entry of transferrin into the tissue during inflammation.

This lack of iron, which is needed for the bacterial electron transport chain, can inhibit the growth of many bacteria. However, this does not help when the inflammation is *in* the intestines.

In the intestines the iron level is elevated and the Haber Weiss reaction is very active.

The Haber Weiss Reaction (aka Fenton reaction)

Iron is a catalyzer in The Haber-Weiss reaction, 'free' iron can catalyze the formation of very injurious compounds, such as the hydroxyl radical (OH) from compounds such as hydrogen peroxide, which are normal metabolic byproducts (Fenton reaction).
The hydroxyl radical is highly reactive, and attacks lipids, proteins and

DNA.
The initial reaction with each of these molecules is the formation of peroxides (e.g., lipid peroxides) that can interact with other molecules to form cross links. These cross-linked molecules perform their normal functions either poorly or not at all.

Iron supplementation may aggravate inflammatory status of colitis. Iron supplementation is one of the principal therapies in inflammatory bowel disease. Iron is a major prooxidative agent; therefore therapeutic iron as well as heme iron from chronic mucosal bleeding can increase the iron-mediated oxidative stress in colitis by facilitating the Fenton reaction, namely production of hydroxyl radicals.

It was concluded that iron supplementation can amplify the inflammatory response and enhance the subsequent mucosal damage in a rat model of colitis. We suggest that the resultant oxidative stress generated by iron supplementation leads to the extension and propagation of crypt abscesses.

Reactive oxygen species may be pathogenic in ulcerative colitis. Oral iron supplements anecdotally exacerbate inflammatory bowel disease and iron levels are elevated in the inflamed mucosa. Mucosal iron may enhance hydroxyl ion production via Fenton chemistry. Conversely, the iron chelator, desferrioxamine, is reportedly beneficial in Crohn's disease.

During inflammation, the superoxide anion (O-2) and hydrogen peroxide (H2O2) are produced by stimulated polymorphonuclear leukocytes and macrophages. The toxic effects of these reactive oxygen intermediates increases when traces of iron are present, because iron catalyzes the formation of the hydroxyl radical (OH). Iron release from ferritin depends on O-2 because it can be prevented by the addition of superoxide dismutase. Catalase and dimethylsulfoxide have no inhibitory effect on iron mobilization.

It seems like DMSO can scavenge the H2O2 Hydrogen Peroxide

molecules. It cannot scavenge the Super Oxide Anion (O-2), however.

Summary

1. Inflammation
2. Superoxide anion (O-2) and Hydrogen Peroxide (H2O2) are produced.
3. The O-2 will release even more iron from the ferritin. Iron overdose in the intestines
4. H2O2 and Iron will form Hydrogen free radicals (Fenton Reaction).

DMSO will remove most of the H2O2 and will increase the iron export by stimulating the transferrin receptors. The Super Oxide Anion is still there, however. When the O-2 can release more iron than the transferrin receptors can export, the vicious cycle is still not broken.

Conclusion

Perhaps DMSO can stop the damage mechanism in the intestines, but maybe it needs some help from an O-2 scavenger also.

DMSO can decrease the amount of free iron

The ability of Friend erythroleukemic cells to bind transferrin and take up its iron increases substantially as a result of dimethyl sulfoxide-stimulated differentiation.

Dimethylsulfoxide (DMSO) induces hemoglobin synthesis and erythroid differentiation of Friend erythroleukemia cells in vitro. Induction is accompanied by increased transferrin-binding activity which is necessary for the cellular acquisition of iron from transferrin for hemoglobin synthesis.

Hydroxyl radical scavengers inhibit TNF-alpha production

Dimethylsulfoxide (DMSO) and deferoxamine (DFX), the latter being an iron chelator which prevents HO formation by blocking the Fenton reaction, were found to inhibit TNF-alpha production in LPS-stimulated human PBMC.

Desferroxamine and Copper/Zinc Superoxide Dismutase

DMSO does two things to stop the Fenton Reaction:

- It neutralizes the H2O2 Hydrogen Peroxide molecules, which are a necessary compound for the Fenton Reaction.
- It activates the transferrin receptors, so the free iron is removed, which is also a necessary compound for the Fenton Reaction.

The parallel with Desferroxamine

- Desferroxamine is also an antioxidant.

Desferroxamine binds the free iron to its molecule, so the Fenton Reaction cannot work.

Mucosal iron may enhance hydroxyl ion production via Fenton chemistry. Conversely, the iron chelator, desferrioxamine, is reportedly beneficial in Crohn's disease.

The parallel with Copper/Zinc Superoxide Dismutase

- Copper/Zinc Superoxide Dismutase is also an H2O2 Hydrogen Peroxide scavenger.
- 82% is very close to the 80-90% success rate on David Gregg's Site.
- Besides this, C/Z Sup.Ox.Dism. is also an O-2 (Superoxide) scavenger

Bovine CuZnSOD was used during an 8-year period as an anti-inflammatory drug in 26 patients with severe Crohn's disease, usually after failure of corticotherapy, or when this drug was avoided because

of side-effects or abscesses.
We obtained 19/26 very good short term responses, and 82% good results on long term evolution.

These results indicate that the anti-inflammatory effects of CuZnSOD were mainly the removal of oxygen free radicals and indirectly the prevention of lipid peroxidation. This study suggests that CuZnSOD may be beneficial in the treatment of patients with ulcerative colitis.

The parallel with 5-ASA (5-aminosalicylic acid)

- 5-ASA is also an antioxidant (hydroxyl free radical scavenger).
- 5-ASA stops the flow of iron into the intestines by removing O(-2)

(5-ASA), when used in therapy, exhibit superoxide and hydroxyl-radical scavenger properties.

When tissue is inflamed, two things are created:

- Hydrogen Peroxide
- The Super Oxide O(-2)

Hydrogen peroxide is one of the elements on the left side of the Fenton Reaction.
(H2O2 + Fe (+2) --> Fe(+3) + OH + Hydroxyl Free Radical)
O(-2) removes the iron from specific iron-carrying cells in the intestine walls.
Fe (+2) (Iron) is the second element on the left side of the Fenton reaction.

So, in fact, 5-ASA does two things:

1. It removes the Hydrogen Peroxide
2. It stops the flow of iron into the intestines by removing O (-2)

The parallel with steroids (like Prednisolon)
Steroids inhibit the secretion of free radicals by Polymorphonuclear neutrophils. 5-ASA (aka Asacol) and Prednisolon are the most effective conventional medicine used for treating Crohn's and UC.

Pretreatment with the iron chelator desferroxamine followed by hydrogen peroxide treatment at 37°C gives a considerable sparing effect.

In contrast, the response to X-rays is not modified by the above chelators, with the exception of mutation frequencies: lower mutant numbers are found in desferroxamine pretreated LY-R cells.

In manufacturing, DMSO is used as an industrial solvent for herbicides, fungicides, antibiotics, and plant hormones.

Medical uses

DMSO is a prescription medicine and dietary supplement. It can be taken by mouth, applied to the skin (used topically) or injected into the veins (used intravenously or by IV).

For the sensitive skin of the face, it should be diluted to 50% strength, in case one is using pure DMSO. It should be diluted to 70% (or less) of full strength for most other areas of the body. Dilute it in distilled water and stir. Do not seal the bottle for several minutes, and do not be alarmed if the solution heats a little. It should only be applied once a day. It will cause burns if applied too often, or in too concentrated a form. There will normally be some slight burning and itching sensations as it absorbs, but there is no need to panic from these sensations. If these sensations become overwhelming, then wash it off, because it is likely that too much was used.

Again, take special precautions to avoid getting DMSO into the eyes, and always apply it near a water facet, in case some accidentally gets into an eye.

DMSO is for external use only (topical use).

Make sure everything involved in the application, and the area to be applied are surgically clean. DMSO has another unique property whereby it will pull other materials into the body, so cleanliness is vital for safety.

Despite these necessary warnings, DMSO is a safe substance to use for treating many disorders, when it is properly used.

DMSO is diluted on exposure to air. Upon topical application, it rapidly penetrates the skin; however, unlike most penetrating solvents, it is not associated with irreversible membrane damage. DMSO can enhance the skin penetration of other drugs. Analgesic and anti-inflammatory effects may benefit patients with rheumatoid arthritis. In addition, DMSO traps free radical hydroxide; its antioxidant properties are thought to be responsible for the prevention of chemotherapy extravasations. A strong garlic taste in the mouth following DMSO administration comes from the exhaled dimethylsulfide (DMS) metabolite.

Dimethylsulfoxide (DMSO) is a widely used chemical solvent because of its high polarity. It is used in the laboratories as a cryo-preservative. DMSO is readily absorbed by the skin and has been studied as a vehicle for topical drugs. DMSO is thought to have analgesic and anti-inflammatory properties and has been used topically to relieve pain and to treat arthritis. Small scale studies conducted in the early 1980s suggested that DMSO may help to relieve peripheral neuropathy and post-thoracotomy pain.

This substance has been recognized as an effective pain killer and anti-inflammatory, but it is not approved by the FDA for anything other than a certain bladder condition called interstitial cystitis. DMSO is a by-product obtained from the process of making paper

out of timber, and it has three primary forms: industrial grade, veterinary grade, and medical grade.

DMSO is taken by mouth, used topically or given intravenously for the management of amyloidosis and related symptoms. Amyloidosis is a condition in which certain proteins are deposited abnormally in organs and tissues.

DMSO is used topically to decrease pain and speed the healing of wounds, burns, and muscle and skeletal injuries. DMSO is also used topically to treat painful conditions such as headache, inflammation, osteoarthritis, rheumatoid arthritis, and severe facial pain called tic douloureux. It is used topically for eye conditions including cataracts, glaucoma, and problems with the retina; for foot conditions including bunions, calluses, and fungus on toenails; and for skin conditions including keloid scars and scleroderma. It is sometimes used topically to treat skin and tissue damage caused by chemotherapy when it leaks from the IV that is used to deliver it. DMSO is used either alone or in combination with a drug called idoxuridine to treat pain associated with shingles (herpes zoster infection).

Intravenously, DMSO is used to lower abnormally high blood pressure in the brain. It is also given intravenously to treat bladder infections (interstitial cystitis) and chronic inflammatory bladder disease. The U.S. Food and Drug Administration (FDA) has approved certain DMSO products for placement inside the bladder to treat symptoms of chronic inflammatory bladder disease. DMSO is sometimes placed inside bile ducts with other medications to treat bile duct stones.

The FDA decided that DMSO was a dangerous drug and notified all the drug companies involved in DMSO research (Squibb, Syntex, Merck) to halt all clinical trials. Then they issued press releases that DMSO caused cataracts even though DMSO had never caused cataracts in any study, animal or human. On the contrary, research has shown that DMSO improves vision and is an effective treatment for retinitis pigmentosa and macular degeneration. The FDA used the

bogus issue of eye damage for several decades to hold back DMSO. DMSO is seven times safer than aspirin yet has been persecuted for decades by the FDA.

DMSO was first reported in 1963 by Stanley Jacob, M.D. of the University of Oregon Medical School, former head of the organ transplant program at Oregon Health Sciences University in Portland. Jacob claimed that DMSO could penetrate skin and produce local analgesia, decrease pain, and promote healing of injured tissue. According to Jacob, more than 40,000 articles on its chemistry have appeared in scientific journals, which, in conjunction with thousands of laboratory studies, provide strong evidence of a wide variety of remarkable properties.

DMSO is one of the most studied but least understood pharmaceutical agents of our time - at least in the United States. Doctors around the world prescribe DMSO for a variety of ailments, including pain, inflammation, scleroderma, interstitial cystitis, and arthritis elevated inter-cranial pressure. Millions of patients were treated with it, without a single reported case of fatality, or serious injury, yet it continues to be ignored decade after decade by conventional medicine.

DMSO binds with water and changes the structure of the water within the cell, which results in the healing of cellular damage. This also increases the permeability of the cell membrane, causing a flushing of toxins from the inside of the cell. DMSO also improves immune function, decreases allergic reactions, increases immunity to infections, prohibits cancer growth, and decreases the potency of toxins. DMSO crosses the blood-brain barrier, and is an excellent agent to help transport other substances throughout the body.

When used for pain relief, chronic pain patients often report relief to a degree they had not been able to obtain from any other source. The anti-inflammatory and pain relief properties of DMSO have made it the most widely used, approved treatment for interstitial cystitis (irritation of the urinary tract) in the world. The treatment is FDA

approved.

DMSO also reduces inflammation by several mechanisms. It is an antioxidant - a scavenger of the free radicals that gather at the site of injury. DMSO also stabilizes membranes and slows or stops leakage from injured cells.

Stephen Edelson, MD, F.A.A.F.P., F.A.A.E.M., who practices medicine at the Environmental and Preventive Health Center of Atlanta, has used DMSO extensively for 4 years. "We use it intravenously as well as locally", he says. "We use it for all sorts of inflammatory conditions, from people with rheumatoid arthritis to people with chronic low back inflammatory-type symptoms, silicon immune toxicity syndromes and any kind of autoimmune process."

Cancer – DMSO as a Transdermal Agent

About 50 years ago, it was discovered that dimethyl sulfoxide (DMSO) had a very high affinity for cancer cells. In other words, DMSO targeted cancer cells.

DMSO could bind to other substances, and still target cancer cells. It is one of the most powerful carrier/solvent known to science. It is able to bind to certain types of molecules, and then carry these molecules inside cancer cells.

An experienced holistic doctor should be consulted before embarking on a treatment course.

DMSO - topically, all by itself

According to Dr. Walker, M.D., DMSO as a penetrating substance is unsurpassed. “It passes through cellular membranes and tissues. It is invariably able to penetrate endothelial coatings of the arterial walls, meninges of the brain, healthy skin, mucous membranes, and other tissues.” It suggests that when injections or intravenous infusion are not available, DMSO, as an anti-cancer agent, can be introduced into

the body safely and effectively through the skin. This is being done for sport injuries, arthritis, shingles, etc. by millions of people since more than 35 years.

Apply the solution with a cotton ball, pad, or even the fingers, to the area to be treated. Put on an ample coating, but not enough that it drips off, and cover the areas surrounding the injured area also, for a couple of inches. If you wish more rapid absorption, you can softly rub the area. If you choose to do this, do not rub too much, or too hard, as you can irritate the skin. If you use your fingers, you do not even have to wash it off - just rub it into your hands. It helps them and aids the tissues and joints,

Do not contaminate the bottle. Always pour some solution into a small glass, cup, or other container, and apply from this container. You don't have to throw out the cotton ball, or pad after each application- just drop it in the glass with the solution you poured out, until you are going to apply it again later. If you want to be extra safe, cover the container with some plastic wrap between applications. I don't bother with this, but it is not a bad idea, as the DMSO can absorb things from the air.

Within a few minutes you will notice the solution being absorbed into the skin. If you do notice some stinging (this may be accompanied by some redness), especially in very tender areas, such as the neck and face, it usually goes away in just a few minutes.

The sooner you apply the solution to the injured area, after injury, the quicker the healing process can begin, and some of the pain and tissue damage can actually be curtailed, and much of the bruising eliminated.

After the initial application, an additional application can be made after one half hour to one hour. You can continue applying the solution thereafter, every hour, or several hours, until the desired relief is obtained. This is quite an individual thing, and varies from

injury to injury and from area to area, and, sometimes, even person to person. You can, and will, experiment on yourself and you will shortly determine what works for you. If you have chronic arthritis, or other pain, you may end up using an application, or two, every day to ease the pain, or keep the pain away entirely.

It would be hard to use too much of a DMSO solution, as it is classified as one of the safest products known. DMSO is naturally present in many of our food products and it has even been conjectured that it most likely exists naturally in human tissue. It is also stated that its derivative, MSM is definitely found at the cellular level. If you use it too often on any given area, or rub too hard, about the only problem you will incur is a little burning and redness. After several days, though this is rare, except in the tenderest areas, you may also notice some of the surface skin peeling, or flaking off, just like in mild sunburn.

If you do put it on too often, rub too hard, or use it on a very tender, thin skinned area, and get the burning sensation and redness, you may also notice some itching - yes, just like in a case of mild sunburn. If this occurs you can use some pure, high quality, skin cream, or plain old honey. If you use skin cream, just make sure it does not have many chemical additives, as they will also be absorbed into the skin, if you are continuing to apply the DMSO solution.

In order to bring enough DMSO into the body to make a difference, it can be applied repeatedly, in every two-three hours if needed. It can also be applied to relatively large areas on the body. Remember that DMSO actively and selectively seeks out cancer cells. This has been proven beyond doubt in animal and human studies. The biochemical reasons are not well understood, but the fact remains that DMSO targets cancer cells. It is also able to reach brain tumors because it is capable of passing through the blood/brain barrier. This has also been proven. According to the clinic where DMSO is infused intravenously to cancer patients, the treatment is used very successfully for aggressive brain tumors.

Not every anti-cancer remedy or substance can be combined with DMSO. Some will neutralize its effects, others will cause complications.

To be absolutely certain that DMSO will not cause nausea, it is better not to use it with an empty stomach. This doesn't mean that one should eat before each application, but the stomach should not be entirely empty.

DMSO sensitivity test

A few people are allergic to DMSO or have very weak livers and can have bad problems with DMSO. Wash your arm carefully and dry it. Then add one drop of DMSO to one spot on your arm and rub it in. Give it about 15 minutes to soak in and then wait several hours. If there is no pain in your liver area you are probably safe in using DMSO which will be the case in 99 people out of 100. To be safe, wait another 24 hours to make sure there is no reaction to the DMSO.

When using DMSO choose sensitive skin areas and keep changing the application spot as often as possible. Also apply over a period of hours each day for maximum of five to seven days, then give a break of at least two or three days.

In cancer treatment DMSO is used to effectively achieve transdermal transfer of cesium chloride. When DMSO is used with cesium chloride, it is important to understand how to take them together. While DMSO is very non-toxic, it can be mildly dangerous to handle, so it is absolutely critical to read articles which covers the safety warnings about using DMSO (e.g. it should NOT be used by pregnant women or women who might become pregnant).

DMSO may give you significant body odor and bad breath. This body odor has been described as an oyster smell or a garlic smell.

The bad breath and/or body odor is caused by the DMSO leaving your body after doing its job. Normally it leaves via the kidneys, but sometimes it leaves through the skin. DMSO is critical to your treatment it grabs hold of the cesium chloride and drives it through the skin and into the cancer cells. For brain cancer patients, it blasts past the blood-brain barrier like it was not even there.

Excretion

Elimination half-time is about four days, however cutaneous application prolongs elimination by about one third. Excretion of DMSO is primarily via urine.

DMSO - orally, all by itself

The premise is the same as with topical application, with one difference. The topical application is not likely to cause serious side effects; the oral ingestion has limits, set by how much DMSO is accepted by the stomach. People with a sensitive stomach may find that more than 2-3 table-spoonfuls will result in nausea or cramps. For maximum and fastest results, DMSO may be taken in small quantity (2 table-spoons a day) over and above the topical application. Never take it on an empty stomach. Eat a good breakfast or a snack before. If there is an allergic reaction to DMSO (not likely, but not impossible), stop using it, and choose another therapeutic approach.

WARNING: Never use DMSO in an enema, never introduce it into the body rectally. If it is squirted in rectally, it will carry toxic fecal matter into the bloodstream through the intestinal wall.

Please note: DMSO in therapeutic quantities has zero toxicity. Should anyone drink several quarts of it, it may cause severe injury, even death. Although it is said to be seven times less toxic than aspirin, at the megadoses level it will be dangerous. ***Do not leave it out where children can reach it.***