



Rhamnan Sulfate

Rhamnan sulfate is a relatively recently recognized compound derived from an edible green seaweed *Monostroma nitidum*. It has been found to be specifically beneficial to the glycocalyx layer of blood vessels which is a protective layer of glycoproteins and other constituents that shields the vessel wall from damage and is intimately associated with endothelial function.

Supplementation with Rhamnan sulfate has been shown to both protect and to help rebuild the glycocalyx when it is damaged by age, dietary factors and other conditions that degrade this protective layer. (1-5)

It has also recently been shown to have antiviral effects. Despite the large size of the molecule, oral dosing has provided significant vascular benefits likely through absorption through specialized areas of the intestine called Peyer's patches. (6-7).

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USES

Endothelial Health and Blood Vessel Protection

The current use of Rhamnan sulfate is to enrich the health of the glycocalyx layer of large and small arteries and veins to improve endothelial health and support blood vessel health. It inhibits hyaluronidase and has antithrombotic effects. Inflammation of the vascular endothelium has been identified as a key factor in the development of vascular pathology in a variety of settings from aging to hypertension to diabetes and tobacco induced chronic changes of the endothelium. Rhamnan sulfate can help to both protect the endothelium from damage. (9-15)

Antiviral and Immunomodulatory Effects

Rhamnan sulfate is not specifically indicated for use against any specific viral agents. It is neither marketed or at the current time said to have any clinical indications in humans for such use. However, research studies have shown activity against a variety of viral agents as delineated below and individuals using it for vascular health could potentially benefit from its antiviral effects if they are confirmed to be present in humans.

Studies have shown antiviral effects against a wide spectrum of viral pathogens from HSV1 and HSV-2 to HIV, Cytomegalovirus [CMV] and measles, mumps, and Influenza. It only has activity against enveloped viruses such as the ones listed above and does not appear to have activity against nonenveloped viruses such as poliovirus, adenovirus, coxsackie virus and rhinovirus.

Rhamnan sulfate also has potentially beneficial general effects on the immune system. Titers of neutralizing antibodies against viral pathogens have been demonstrated to be higher in rhamnan sulfate treated patients. (16-20)

USUAL DOSE / MODE OF ADMINISTRATION / DURATION OF USE

Despite the large molecule size, the administration of rhamnan sulfate is by the oral route. The dosing

of currently available products is proprietary. Limited references in research studies and patent applications for endothelial health benefits use doses of 7.5 mg/kg. How this relates to currently marketed combination products is uncertain.

Use of an extended period of time – months to years can help heal and reinforce the endothelium and thereby potentially promote and support vascular health.

ACTIVE CONSTITUENTS / BIOCHEMISTRY

Rhamnan sulfate is considered to be a heteropolysaccharide of L-rhamnose. The sulfate component is covalently bonded to the polysaccharide. The polysaccharides isolated from the seaweed *Monostroma nitidum* are diverse in their sizes ranging from a few thousand molecular weight units to one million.

MECHANISM OF ACTION AND CLINICAL EFFECTS

Rhamnan sulfate has a broad spectrum of beneficial effects mediated by complex interactions with the dynamic glycocalyx layer and the endothelium. Its anticoagulant effect is believed to be similar to unfractionated heparin in inhibiting factor Xa and thrombin. Rhamnan sulfate is absorbed and incorporated into the luminal surface of vascular endothelium in both arteries and veins where it enhances the structural integrity of the endothelium. It has an antiinflammatory effect on endothelial cells and stabilizes platelet aggregation as well as lipopolysaccharide induced endothelial inflammation. It has additionally been shown to lower blood sugar and LDL cholesterol levels modestly. (21-30)

Immune effects of rhamnan sulfate are multifaceted. Rhamnan sulfate has been shown to stimulate host production of neutralizing antibodies against Influenza A. It may also impair viral adsorption, penetration, and the replication. It has strong effects in the inhibition of viral dissemination. Rhamnan sulfate may trigger both endocytosis and phagocytosis of pathogens. It has been demonstrated to inhibit viral replication and spread of virus between cells. (31-50)

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CONTRAINDICATIONS / SIDE EFFECTS

There are no reported specific contraindications. Allergic reactions are possible as with any biologic substance. Data on specific side effects is not readily accessible.

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