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The Importance of Biomechanics for Varicose Veins

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Abstract
The article reflects a perspective focusing on the sedentary lifestyle and dietary habits that have increased with technological advancements in today's world. It emphasizes the widespread consumption of processed and refined foods, which could weaken the body's defense mechanisms and highlights the effects of a stressful lifestyle. Additionally, it suggests that individuals who consume excessive and unbalanced diets should incorporate natural foods with high antioxidant content. The article discusses how the dietary habits of individuals with varicose vein problems could affect their condition. It suggests that natural products containing high antioxidants could strengthen the body's defense mechanisms against oxidative stress and reduce the formation of varicose veins and similar conditions. Furthermore, the article emphasizes the preference for minimal invasive procedures in treating individuals with varicose veins. The advantages of these procedures include reduced risk of complications, minimal pain, and a quick return to daily life activities for patients.

Keywords: *Biofluid, Varicose, Veins, Blood circulation*

1. Introduction

For years, our heroic legs, which have borne the burden of our entire body and life, carry a problem derived from the Latin word "varix," meaning "twisted": Varicose veins disease. Present-day living conditions lead us to sit more and walk less. Escalators, elevators, the habit of driving, hours spent sitting at desks—all contribute to a sedentary lifestyle. The rapid and mass shopping habits in indoor shopping malls have almost made us forget the once enjoyable atmosphere of bazaars. As time goes by, our walking distances shorten, and the mobility of those of us competing with the pace of life decreases. The muscles around the veins in our legs support circulation by helping the blood return to the heart. However, the sedentary lifestyle brought about by modern living weakens the pumping power of these muscles. As a result of the inability of the veins to return the blood to the heart, the blood pools in the legs, the veins become more prominent, and over time, it becomes a significant health issue. Reflecting on the effects of a sedentary lifestyle on the formation of varicose veins is the first step in combating this widespread problem. One of the most important components of the disinfection system is the liquid transfer pump and spray nozzles.

The heat pumps produced in the world are no better than the characteristics of the Carnot cycle, and all practical cycles are as close as possible to this characteristic. [1]

COPh in pumps depends on several factors. The temperature difference between the condensation and evaporation temperature basically determines the efficiency: the smaller the difference, the higher the COPh.[1].

In spray nozzle systems, pressurized mains water or a liquid engine that will provide the necessary pressure to the spraying process are commonly used. In this project, a liquid transfer pump working with DC 12V was preferred. The reason for this is that the pump will be able to spray to the desired distance even in adverse weather conditions by providing sufficient pressure in the spraying process.For this reason, Kemos brand liquid transfer pump, which is smaller in size and simple to use, can operate at lower power, instead of more noisy and costly equipment such as compressors. The pump has a power of 30W and has the capacity to transfer 15 liters of liquid per minute. The dimensions of the pump used in the device are 16x4.4 mm. (Figure

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2. What is varicose veins

The history of varicose veins dates back to ancient times in human history. Varicose veins were first described in the Ebers Papyrus in 1550 BC. Signs of varicose veins can be seen in many sculptures from that period. The history of surgical treatments extends back to the Roman Empire. Roman soldiers may have been the first to apply pressure therapy by wrapping bandages made of gazelle skin around their legs in preparation for long marches. The first intravenous treatment for varicose veins directed by Hippocrates involved inserting a copper wire into the vein. Sclerotherapy began in the 1860s as a treatment method performed with needles. In this method, a special substance injected into the vein damages the vein walls, causing the vein to close. Laser treatment for varicose veins started in a more modern era, in the 1980s. The aim of this treatment is to direct laser light to the inner surface of the vein to reduce or close varicose veins. All these historical developments reflect the evolution of varicose vein treatment and medicine.

Varicose veins:

Varicose veins are enlarged, swollen superficial veins that can be felt under the skin, typically with a diameter greater than 3 mm.

Arteries in the body form a network that delivers blood to tissues, while veins return this used blood back to the heart. Veins in the legs utilize mechanisms such as the elastic walls under the influence of gravity, tiny valves, and contractions of the lower leg muscles to carry this blood upwards. However, as age progresses, the elasticity of the veins decreases. Hardening and ballooning of the veins lead to the malfunctioning of the tiny valves. In this case, the blood that should go to the heart forces its way back due to the hardened walls of the veins, giving the skin a varicose vein appearance. This process is a condition that arises with the loss of vein elasticity and the inability of the valves to function properly [1].

3. How Leg Veins Work Leg Veins

The veins in the upper part of the body are faced with a more complex task compared to those in the lower part. This is because gravity does not assist the blood in the veins of the legs to return to the heart; instead, it acts in the opposite direction. Therefore, the veins in the legs have numerous one-

way valves. Additionally, the muscles surrounding these veins gently massage them from bottom to top. Contraction of the leg muscles opens the valves inside the veins and pushes the blood upwards. This process allows the blood to move towards the heart in opposition to gravity. When the muscles relax, the valves close, preventing the blood from flowing back to the feet. Thanks to this dynamic system, the veins in the legs effectively transport blood to the heart despite the challenges posed by gravity. This mechanism contributes to the efficient functioning of the circulatory system by regulating the function of the veins in the legs. When we think about the venous system in the legs, it resembles a staircase. One foot of the staircase represents the deep veins located deep inside the leg, which carry blood back to the heart. The other foot represents the superficial veins, especially the Great and Small Saphenous veins, which are closer to the surface. The steps of the staircase are the connecting or perforator veins that link the superficial veins to the deep veins. Deep veins serve as the main highways in the leg and therefore cannot be removed or replaced. The Great Saphenous vein starts from the inside of the ankle and progresses along the inner side of the leg, connecting to the deep veins at the level of the groin. The Small Saphenous vein starts from the outside of the ankle, progresses along the back of the calf, and connects to the deep veins behind the knee. Other veins are also found around the Great and Small Saphenous veins. Connecting veins are found in many places along the leg. Unlike the deep veins, superficial and connecting veins can be bypassed when necessary. However, these veins should not be visible under normal conditions. These complex venous systems contribute to the circulation of the legs, ensuring the healthy functioning of the body [2].

4.Diagnosis of varicose veins

The diagnosis of varicose veins is primarily made through physical examination, but Doppler ultrasound is recommended to determine the treatment method. Doppler ultrasound is a harmless and painless diagnostic method that provides detailed information about the diameter of blood vessels, the movement of blood within them, the function of the valves in the vessels, and their depth. It can be applied to everyone without any side effects. The ultrasound scan of the veins shows the vein and its valves. The question of why ultrasound should be performed for all patients with varicose veins is based on the following reasons: 1. Identifying invisible problems: Most varicose veins caused by bleeding vessels (reflux disease) are visible to the eye, but varicose veins caused by valve insufficiency cannot be seen or manually controlled. These blood vessels can be imaged in detail using color Doppler ultrasound.

2. Mapping of diseased veins: This ultrasound creates a "map" of diseased veins. This chart is prepared for each varicose vein patient, and treatment is planned according to this chart.

3. Imaging capability: Color Doppler ultrasound can be used to visualize not only subcutaneous varicose veins that cannot be seen with the naked eye but also the arterial and deep venous systems of the leg.

4. Venography: Viewing the leg veins by taking color films. Color film provides much more detailed information than ultrasound.

It is important to use color Doppler ultrasonography for the detection of diseased veins and the determination of treatment plans. Before starting varicose vein treatment, the patient's vascular system should be thoroughly examined, and the treatment plan should be based on this information [3].

5. Vein insufficiency classifies varicose veins in the legs into three main types according to their size and proximity to the skin

1. Large varicose veins; This type of varicose veins protrudes significantly beyond the skin. They are usually caused by valvular insufficiency of large superficial veins. These varicose veins are visible varicose veins that protrude from the skin, forming large folds, and can be easily detected by hand or eye. They are visible when standing but may decrease or disappear when the legs are raised.

2. Medium-sized varicose veins (reticular veins); It contains 2-mm-diameter varicose veins that are blue-green in color and rise slightly from the skin. They usually result from valvular insufficiency of small superficial veins. Although they are smaller than large varicose veins, they can be seen on the skin surface.

3. Spider varicose veins; Although these varicose veins do not extend far beyond the skin, they are red-purple varicose veins with a diameter of less than 1-2 mm. They usually result from valvular insufficiency of one or more small-diameter superficial veins. They are not felt and are usually red. They may form spatially generalized linear patterns, spider web-like formations, or star-shaped designs. They can wrap your entire leg [4].

6. Compression Stockings Treatment (Varicose Vein Stockings)

Special compression stockings play a crucial role in treatment. While patients may perceive it as a simple treatment and sometimes fail to comply with it, compression stockings are considered the gold standard in varicose vein treatment. They are utilized both for treatment and prevention. Patients with varicose veins should not purchase compression socks from a pharmacy or store without consulting a physician. Given the various types and pressures of compression stockings available, a doctor will recommend the appropriate type after evaluating the severity of the condition through examination and tests. Random purchases may lead to more harm than good. It's important for the patient to get measured for compression stockings themselves. An authorized person should take measurements directly from the patient's leg to ensure the correct size and compression level. Compression stockings should be worn for 5-10 minutes after waking, before standing up for long periods, and after lifting weights. They should not be removed when standing for extended periods.

The importance of varicose stockings is as follows:

1. Blood Pumping Function: Varicose stockings attempt to pump blood from the foot towards the heart when the valves in the legs fail to function properly.

2. Muscle Support: The stockings provide support to the calf muscles, enhancing muscle tissue.

3. Increasing Pump Power: By increasing the strength of the muscles below the knee and enhancing pump power, they improve blood circulation.

4. Reducing Edema: Wearing them at appropriate times can reduce edema and prevent its formation.

5. Supporting Lymph Circulation: They support lymph circulation, maintaining fluid balance in the body.

6. Increasing Blood Flow Rate: By increasing the flow rate of blood towards the heart in the veins, they support the circulatory system.

7. Preventing Varicose Ulcers: Varicose stockings can prevent the formation and causes of varicose ulcers.

Varicose stockings support blood circulation in the legs, providing many positive effects and helping improve the overall health of varicose patients [5].

Surgical Treatments of Varicose Veins, Removal of Varicose Veins (Stripping Technique):

The traditional surgical method known as the "vein stripping technique" involves the removal of the

varicose vein from its location. This method typically involves larger incisions. However, with modern surgical techniques, it can be performed with smaller incisions and precise techniques that reduce scarring. The stripping technique has been practiced for many years and generally yields successful results.

Non-surgical treatments of varicose veins, Varicose Vein Surgery with Laser or Radiofrequency:
Non-surgical treatment options for varicose veins include interventional procedures using laser or radiofrequency energy. In this technique, a needle is inserted into a superficial vein, and the vein is sealed from the inside using a high-temperature catheter. Additionally, the enlarged side branches of varicose veins located below the knee are typically removed through small incisions of 2-3 mm [6].

7. Aesthetic Treatments for Varicose Veins
1. Sclerotherapy; (Needle Therapy, Foam Therapy)
2. Application Method: A thin needle is inserted into the diseased vein, and a drying agent medication is injected.
3. Medications Used: Solutions containing high concentrations of salt are typically used. Procedure Duration: It is a painless procedure lasting approximately 15-20 minutes.
4. Repetition: Depending on the severity of the varicose veins, multiple sessions may be required.
5. Immediate Recovery: Patients can usually return to their daily activities immediately after the procedure.
6. Effects and Side Effects: The injected medication disrupts the inner lining of the vein, leading to its closure. The closed vein is gradually absorbed and eliminated by the body. This process does not harm the body because these thin veins are generally non-circulating, weakly structured, and prone to bleeding [7].

8. The Importance of Biofluids for Varicose Vein Disease
1. Biofluids are substances used to facilitate more effective circulation of fluids and blood in the body. Varicose vein disease typically arises from irregular pooling of blood in the veins of the legs and the subsequent dilation of the veins. Biofluid supplements can offer various advantages in varicose vein treatment. Here is the importance of biofluids for varicose veins:
2. Supporting Circulation: Biofluids can support the circulatory system, aiding in more effective circulation of blood throughout the body. This characteristic can help reduce the pooling and dilation of blood in varicose veins.
3. Antioxidant Effects: Some biofluids possess antioxidant properties. Antioxidants can combat free radicals, thereby preventing cellular damage. They can assist in reducing inflammation and damage in

varicose veins.
4. Strengthening Vessel Walls: Biofluids can contribute to strengthening vessel walls and increasing their elasticity. This characteristic can help varicose veins become more resilient and prevent their expansion.
5. Supporting Lymph Circulation: Biofluids can maintain the fluid balance in the body by supporting lymph circulation. They can particularly reduce edema accumulation in the legs and contribute to more effective functioning of the lymphatic system.
6. Reducing Inflammation: Some biofluids have properties that reduce inflammation. Reducing inflammation in varicose veins can alleviate symptoms and improve overall circulation health.
It is important to note that consulting with a healthcare professional before using biofluid supplements is crucial. Everyone's health condition is different, and expert advice on the suitability of supplements considering individual needs and conditions is essential.
7. Highlighting the potential importance of biofluid supplements containing Omega-3 fatty acids such as fish oil in varicose vein treatment. Omega-3 fatty acids, particularly abundant in fish oil, are nutrients that can contribute to strengthening vessel walls. Here are factors explaining the importance of such biofluid supplements for varicose veins:
7.1. Strengthening Vessel Walls: Omega-3 fatty acids possess antioxidant properties and can reduce inflammation and oxidative stress. This can help strengthen vessel walls, thereby reducing varicose vein formation by preventing their expansion and weakening.
7.2. Antioxidant Effects: Omega-3 fatty acids are antioxidants that combat free radicals, preventing cellular damage. Varicose veins often result from damage to vessel walls. Through their antioxidant properties, omega-3 fatty acids can reduce this damage.
7.3. Supporting Circulation: Omega-3 fatty acids can make blood more fluid and support the circulatory system. This feature can alleviate varicose vein symptoms by promoting smoother blood circulation.
7.4. Reducing Inflammation: Varicose veins often result from an inflammatory condition. Omega-3 fatty acids are known for their anti-inflammatory effects. Thanks to these properties, they can reduce the symptoms of varicose veins and contribute to

controlling inflammation.
However, since every individual's health condition is different, it is important to consult with a healthcare professional before using such supplements. Expert advice can help in creating the most effective treatment plan considering personal health status and needs [8].

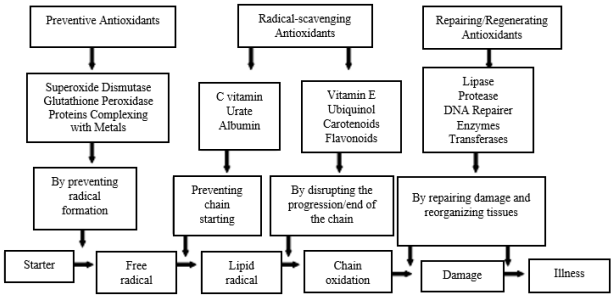

Figure 1. Antioxidants [9].

As seen in the figure, antioxidants are divided into those that prevent radical formation, store the radicals formed, and repair the damage. Primarily preventing AOs and inhibiting free radicals. Radicals capture these AOs and non-inhibitors and prevent the chain from being initiated or propagated. When cells are damaged by unstoppable radicals, reparative / regenerative AOs come into play, preventing disease by repairing or regenerating cells. AO and its natural sources are oilseeds, leaves, roots, spices, grain products, vegetables, fruits, tea, algae, animal products and enzymes. Sources of AO are usually obtained through diet, which allows supporting the body's defense system. Figure 2 shows the ratio of AOs and food components and the proportions of food in the protective power of AOs. A balanced diet is a fact that helps prevent diseases.

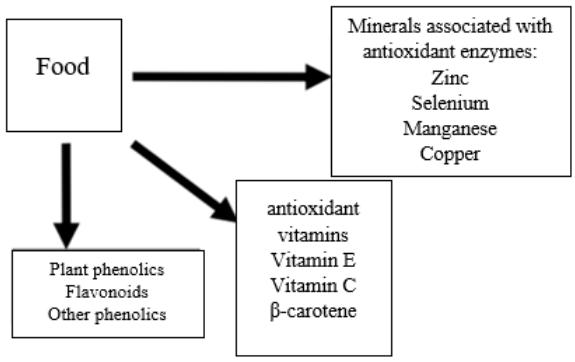

Figure 2. Food relationship with antioxidant defense systems[10].

In this text, it is stated that atherosclerosis is one of the main causes of cardiovascular diseases worldwide and especially in Turkey. Atherosclerosis is generally characterized by increased vascular thickness and loss of flexibility. Atherosclerosis occurs with changes in the vascular wall, accumulation of lipids, blood products, carbohydrates and calcium deposits.

The development of atherosclerosis is explained by three separate theories: response to damage, response to accumulation and oxidative cahnge. According to the damage response theory, with damage to the endothelium, the inner surface of the vessel loses its lubricity; Platelets and leukocytes adhere here, they grow, smooth muscle cell migration to the inner part of the vessel begins, and they proliferate. According to accumulation response theory; Oxidized LDL leaks into the vascular wall, initiates inflammation, and this debris moves into the vascular space and turns into plaque. According to the oxidative change theory, oxidized LDL stimulates monocytes and prevents their movement in the vessel. Atherosclerosis is associated with factors such as high blood lipids, high blood pressure, diabetes and tobacco use, which are important and preventable risk factors. In addition, there are important but unpreventable risk factors such as age, gender (male), and genetic structure. Atherosclerosis can cause blockages in blood vessels and increase blood pressure, which can lead to serious health problems such as brain hemorrhage, stroke, and heart attack. In this process, it has been stated that antioxidants can prevent or reduce the formation of atherosclerosis, especially by reducing the effects of oxidized LDL. As a result, the need to review the studies conducted to understand the relationship between atherosclerosis and antioxidants and their effects on cardiovascular health is emphasized.

Carotenoids are known precursors to vitamin A activity and may have various health benefits. These substances have positive effects on arteriosclerosis. The main functions of carotenoids include various functions such as preventing atherosclerosis, trapping free radicals, preventing the oxidation of LDL, protecting DNA against cancer, having a positive effect on the immune system and preventing tumor formation. The strong antioxidant properties of carotenoids are related to their ability to interact with free radicals and neutralize them, thanks to the conjugated double bonds in their structures. Carotenoids, especially β-carotene and lycopene, can reduce oxidative stress by trapping free radicals. While lycopene is found in foods such as tomatoes and their products, watermelon, papaya and rose hips, β-carotene; alpha carotene in foods such as carrots, apricots, mangoes, red peppers, kale, spinach and broccoli; lutein and zeaxanthin in foods such as

carrots, pumpkin, corn and yellow pepper; It is found in foods such as kale, broccoli, peas, brussels sprouts and lettuce. A panel study observed that increasing carotenoid intake from fruits and vegetables may reduce the risk of cardiovascular disease, especially in elderly individuals. Therefore, regular intake of carotenoids through a variety of fruits and vegetables may support overall health and have a protective effect against cardiovascular problems such as atherosclerosis [11].

Vitamin E is the largest antioxidant that plays important roles such as slowing down the formation of atherosclerosis and the development of cancer, fighting free radicals and protecting unsaturated fatty acids in the cell membrane against oxidation. This vitamin has antioxidant properties, especially in the form of α-tocopherol. Vitamin E [12] helps protect cells by neutralizing radicals formed during lipid peroxidation. In addition, the oxygen retention capacity of tocopherol is highest in α-tocopherol, and thanks to this feature, it has the ability to protect polyunsaturated fatty acids from peroxidation. Vitamin E, which is divided into two main groups: tocopherols and tocotrienols, is found in vegetable oils, green leafy vegetables and nuts. While it is found in high amounts especially in peanuts, almonds, cottonseeds and flaxseeds, it is present in trace amounts in olive oil. Vitamin C is a water-soluble vitamin and has a number of important functions. It has functions such as collagen synthesis, preventing the oxidation of LDL cholesterol and trapping free radicals. Additionally, vitamin C [13] can prevent the occurrence or progression of diseases such as cancer, heart diseases and nervous disorders by enabling the conversion of oxidized α-tocopherol back into α-tocopherol. Vitamin C is abundant in fresh vegetables, fruits, and especially citrus fruits. As important antioxidants for the body, these vitamins can reduce cellular damage by combating free radicals and provide various health benefits.

It shows that among B vitamins, especially pyridoxine (vitamin B6), cobalamin (vitamin B12) and folic acid may play a protective role on heart health. Especially folic acid, when taken alone or with other B vitamins, can reduce homocysteine levels in the blood. Homocysteine, when present at high levels, may increase the risk of heart disease. These B vitamins are commonly found in animal foods, such as organ meats, meat, milk and eggs. These vitamins can also be found in fresh green vegetables. Adequate intake of B vitamins from these food sources may be important for protecting heart health.

Phenolic compounds, especially flavonoids, have antioxidant properties such as capturing free radicals, disrupting the radical chain, chelating with minerals, preventing platelet adhesion and atherosclerosis [14]. Dietary intake of these compounds, especially flavonoids, can lower cholesterol levels and reduce cellular damage

through their antioxidant activities. Green tea is a rich source of flavonoids and has properties such as protecting heart health, slowing down arteriosclerosis and preventing clot formation. Phenolic compounds are substances containing the benzene ring, found in fruits, vegetables, tea and other herbal sources and known for their antioxidant properties. These components can be absorbed into the body through minerals as well as food, for example minerals such as selenium, copper, zinc and manganese [15].

Selenium is a mineral that plays an important role in antioxidant defense systems in the body and is a cofactor of glutathione peroxidase. Glutathione peroxidase has the task of protecting endothelial cells from the effects of oxidized LDL cholesterol[16]. Low levels of selenium can be seen
in the blood of individuals with various health problems such as heart diseases and atherosclerosis. In case of selenium deficiency, a condition called Keshan may occur, which causes heart muscle disorder. Selenium can be obtained from a variety of food sources, such as seafood, meat and meat products, and grains.

Glutathione is a tripeptide and serves as a cofactor of many enzymes. It also has radical scavenging properties and functions as a substrate for glutathione peroxidase and glutathione-S-transferase enzymes [17].

9. Conclusion

Nowadays, with the increase in technological opportunities, people with a sedentary, competitive and stressful lifestyle lead them to consume processed, refined and denatured foods. This diet is expected to weaken the body's defense system. On the other hand, people with excessive and unbalanced nutrition and high blood cholesterol and fat levels should consume more antioxidant-rich foods. Natural products with high antioxidant content can increase the body's defenses against oxidative systems, in particular, prevent the oxidation of LDL and other cellular structures and reduce the formation of varicose veins. It is recommended that patients with varicose veins prioritize nutrition and then minimally invasive

procedures. These procedures have advantages such as reducing the risk of complications, minimizing post-procedure pain, and allowing patients to return to their daily lives more quickly. It is recommended that more research be conducted on the quality of life of people with varicose veins and that healthcare professionals provide education to these patients on this subject. A combination of these approaches is important to improve the quality of life of people with varicose veins and prevent disease.

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