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## **Fueling lymphatic health: the emerging role of nutrition in lymphedema management**

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## **Abstract**

Lymphedema is a chronic condition characterized by lymphatic fluid accumulation in interstitial tissues, often leading to inflammation and fibrosis. While Complete Decongestive Therapy (CDT) is the standard treatment, there is growing interest in nutritional strategies to enhance treatment outcomes. Evidence suggests that specific dietary approaches, such as hypocaloric and ketogenic diets, along with supplements like selenium and hydroxytyrosol, can reduce edema, improve lymphatic function, and modulate inflammation. These strategies show promise as adjuncts to traditional treatments, although further clinical research is necessary to confirm their effectiveness. Personalized nutritional interventions may be required for optimal outcomes.

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## **Introduction**

Lymphedema is a chronic, progressive condition characterized by the accumulation of lymphatic fluid in interstitial tissues, resulting in swelling, inflammation, and, in advanced stages, tissue fibrosis. It can occur following surgical interventions, such as lymph node dissection, or as a consequence of radiation therapy, trauma, or congenital abnormalities in the lymphatic system. Commonly affecting the limbs, it leads to pain and reduced mobility and can cause significant psychological and social challenges for patients.<sup>1</sup>

Current management of lymphedema primarily relies on Complex Decongestive Therapy (CDT), a comprehensive approach involving manual lymphatic drainage, compression bandaging, targeted exercises, and meticulous skin care. CDT remains the gold standard for reducing limb swelling and maintaining lymphatic function, but it requires continuous patient compliance and, in some cases, may not fully alleviate symptoms, particularly in advanced stages.<sup>2</sup> Hence, additional strategies are being investigated to improve therapeutic outcomes.<sup>3</sup> Despite the growing interest in nutritional interventions, the literature remains scarce on this topic. This paucity of evidence highlights the need for further investigations, as nutritional strategies have the potential to play a significant role in improving outcomes in Lymphedema (LYM) management.

Emerging research has turned attention to nutritional interventions as a potential complementary treatment for lymphedema. Diet and specific supplements are being studied for their capacity to modulate inflammation, reduce oxidative stress, and support lymphatic function. This brief report examines the evidence from recent studies that

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explore how targeted nutritional strategies can contribute to lymphedema management and improve patient outcomes.<sup>4</sup>

### ***Nutritional interventions for edema reduction***

Edema, or the abnormal fluid accumulation in tissues, is the hallmark of lymphedema. One of the most promising research areas focuses on the potential for specific diets to reduce the volume of this fluid accumulation. Hypocaloric diets have been found to be particularly beneficial for patients with lymphedema, especially those who also struggle with obesity, a known exacerbating factor.<sup>5</sup> Weight reduction through a controlled calorie intake has been linked to significant decreases in limb volume. In addition to low-calorie diets, other dietary approaches, such as ketogenic and low-carbohydrate diets, have shown promise in reducing lymphatic fluid accumulation. These diets promote lymphatic drainage by inducing Vascular Endothelial Growth Factor C (VEGF-C) production, which enhances lymphangiogenesis. Nutrients like omega-3 fatty acids and polyphenols, including curcumin, demonstrate potent anti-inflammatory effects and help mitigate oxidative stress, a critical factor in fibroadiposis transformation of tissues.<sup>1</sup> In one study, women with breast cancer-related lymphedema who adhered to a low-calorie diet combined with synbiotic supplementation (a combination of probiotics and prebiotics) showed a notable reduction in limb volume compared to a control group on a placebo diet.<sup>6</sup> This suggests that nutritional modulation can directly impact the extent of edema by addressing underlying factors such as inflammation and oxidative stress.

The ketogenic diet, characterized by a high-fat, low-carbohydrate intake, has also been

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explored for its potential to reduce edema. Studies suggest that inducing ketosis may improve lymphatic drainage by promoting lymphangiogenesis - the formation of new lymphatic vessels - which can help reduce tissue fluid buildup.<sup>3</sup> Additionally, animal models have shown that a ketogenic diet can increase VEGF-C, a protein involved in lymphatic vessel growth, thereby enhancing lymphatic function.<sup>3</sup> However, it is essential to consider the potential contraindications of these diets, particularly ketogenic and low-carbohydrate regimens. Long-term adherence to restrictive diets may lead to nutritional imbalances, gastrointestinal disturbances, and potential cardiovascular risks in predisposed individuals. Therefore, medical supervision is strongly recommended when implementing these interventions.

### ***Modulation of inflammation and oxidative stress***

Chronic inflammation is a key factor in the progression of lymphedema, contributing to increased vascular permeability and subsequent fibrosis of tissues.<sup>7</sup> Nutritional strategies that target inflammation have shown promise in mitigating these effects. Diets rich in anti-inflammatory nutrients, such as omega-3 fatty acids, polyphenols, and other antioxidants, have been linked to improved lymphatic function and reduced edema. Foods high in antioxidants, including berries, leafy greens, and olive oil, can help counteract oxidative stress, which is a significant contributor to tissue damage in lymphedema.<sup>8</sup>

Supplements such as selenium and hydroxytyrosol, both known for their strong antioxidant properties, have demonstrated efficacy in reducing oxidative damage and promoting lymphatic health.<sup>9</sup> In a clinical trial, selenium supplementation significantly

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decreased oxidative stress markers in patients with secondary lymphedema. Similarly, hydroxytyrosol, derived from olive oil, has shown potential in reducing inflammation and improving lymphatic drainage without adverse effects.<sup>5</sup> Recent findings by Bölükbaşı *et al.* reinforce the role of dietary interventions in managing lymphedema. Their study demonstrated that nutritional strategies targeting inflammation and oxidative stress can enhance lymphatic drainage and improve clinical outcomes.<sup>10</sup> This highlights the potential for further research into personalized dietary approaches for lymphedema patients.

### ***Fibroadiposis transformation in lymphedema***

One of the hallmarks of advanced lymphedema is the fibroadiposis transformation of tissues. Chronic inflammation and prolonged fluid accumulation result in fibrosis and fatty infiltration, leading to irreversible structural changes. These changes exacerbate the condition, highlighting the importance of early and targeted interventions, including weight management and anti-inflammatory nutritional strategies. Curcumin, polyphenols, and omega-3 fatty acids have demonstrated potential in counteracting this fibrotic transformation, offering promising therapeutic benefits.

### ***Impact on quality of life***

In addition to physical improvements, dietary interventions may have a positive impact on the overall quality of life for lymphedema patients. Although the results are mixed, some studies report that patients following specific dietary protocols, such as hypocaloric

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or ketogenic diets, experience not only reductions in limb volume but also improvements in energy levels and mobility.<sup>11,12</sup> A significant factor in improving lymphedema outcomes is weight reduction in obese and overweight patients. Clinical evidence and daily practice consistently show that managing body weight through hypocaloric diets can substantially reduce edema and improve patient mobility. Addressing obesity through tailored weight management strategies remains a cornerstone for improving lymphedema symptoms and patient well-being. However, it is essential to note that not all patients report significant changes in their perceived quality of life, suggesting that further research is necessary to determine which nutritional strategies are most effective for improving both physical symptoms and overall well-being.<sup>11</sup>

### ***Personalized nutritional approaches***

Given the variability in patient responses to dietary interventions, personalized nutrition plans tailored to individual needs may be crucial for optimizing outcomes. Factors such as age, comorbidities, and the severity of lymphedema should be considered when designing a nutritional plan. Personalized approaches that combine weight management, anti-inflammatory diets, and targeted supplementation may offer the best potential for improving patient outcomes in a holistic and sustainable manner.<sup>12</sup>

### **Conclusions**

Nutritional strategies, including targeted diets and supplements, offer a promising adjunct to traditional lymphedema treatments. Although preliminary evidence supports their

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efficacy in reducing edema, improving lymphatic function, and modulating inflammation, further research is necessary to confirm these benefits in larger patient populations. Personalized interventions, tailored to individual patient needs, may be the key to optimizing outcomes in lymphedema management.

*Ethical concerns*

It is crucial that any nutritional intervention is implemented under medical supervision to mitigate risks, particularly in patients with comorbidities or specific dietary contraindications.

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