Chapter

Oral Catechins and Epicatechins as a Treatment Modality for Hemorrhoids

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Abstract

Hemorrhoids, a prevalent medical condition impacting millions globally, frequently necessitate effective yet minimally invasive treatment methods. This review delves into the prospects of utilizing oral catechins and epicatechins, naturally occurring polyphenolic compounds present in diverse dietary sources, as an innovative avenue for addressing hemorrhoids. These compounds have antioxidant and anti-inflammatory attributes, which may help alleviate hemorrhoid symptoms. An understanding of the anatomy and pathophysiology of hemorrhoids, emphasizing the need for accessible and versatile treatment options. Subsequently, the focus turns to a detailed exploration of catechin and epicatechin, encompassing their chemical composition, natural origins, and mechanism of action. The core of this review presents a comprehensive analysis of the existing literature, including randomized controlled trials that examine the efficacy of oral catechin and epicatechin supplementation in alleviating hemorrhoidal symptoms. To conclude, this article highlights the potential of oral catechin and epicatechin supplementation as a non-invasive and natural approach to managing hemorrhoids. While promising findings have emerged, further research is essential to solidify their role in hemorrhoid treatment. The comprehensive assessment of existing literature and critical evaluation of these compounds' mechanism of action provides valuable insights into their viability as a treatment modality for this common and often distressing medical concern.

Keywords: hemorrhoids, polyphenolic compounds, catechins, epicatechins, antioxidant, anti-inflammatory

1. Introduction

Anorectal disorders constitute a diverse group of medical conditions that affect the complex anatomical and physiological structures of the anorectal region. These disorders encompass a wide range of conditions, including hemorrhoids, perianal pruritus, anal fissures, functional rectal pain, perianal abscess, condyloma, rectal prolapse, and fecal incontinence among others [1]. Collectively, it can lead to significant discomfort, impaired quality of life, and even life-threatening complications if not promptly and effectively managed.

Despite their prevalence and clinical significance, anorectal disorders remain an under-discussed and often stigmatized area of medical research.

The anorectal region serves critical functions in the human body, including fecal continence, waste elimination, and gas control. Dysfunction in this region can result from various factors, including genetic predisposition, lifestyle choices, and underlying medical conditions. While some anorectal disorders are acute and self-limiting, others can develop into chronic conditions that require complex and multidisciplinary approaches to treatment.

The exploration of anorectal disorders presents a unique challenge due to the intricate interplay between biological, psychological, and sociocultural factors. As such, comprehensive research is essential to unravel the underlying causes, mechanisms, and effective management strategies for these disorders. This review article aims to delve into the intricacies of anorectal disorders, shedding light on their etiology, clinical presentation, diagnostic approaches, and a spectrum of treatment options. By synthesizing existing knowledge, this paper seeks to contribute to a deeper understanding of anorectal disorders and to stimulate further research in this important yet often overlooked field.

In the subsequent sections, we will discuss the prevalence of anorectal disorders, elucidate the anatomical and physiological basis of these disorders, examine the intricate web of contributing factors, and explore therapeutic interventions. By addressing these aspects, we hope to provide clinicians, researchers, and healthcare professionals with a comprehensive resource to enhance their ability to diagnose, treat, and manage anorectal disorders effectively. Moreover, this research aims to foster greater awareness and destigmatization of anorectal disorders, encouraging individuals to seek timely medical attention and ultimately improve their overall well-being.

2. Pathophysiology of hemorrhoids

The pathophysiology of hemorrhoids involves a complex interplay of vascular, mechanical, and anatomical factors that contribute to the enlargement and swelling

Pathophysiological theories of hemorrhoids	Description
Vascular theory	Weakening of connective tissue supporting anal cushions leads to blood vessel engorgement.
Increased venous pressure	Elevated intra-abdominal pressure from straining or constipation causes vein dilation.
Congenital weakness	Genetic predisposition to weak blood vessel walls and connective tissue in the anal area.
Dysfunction of smooth muscle	Abnormalities in smooth muscle function result in blood vessel dilation and pooling.
Inflammation and microtrauma	Chronic inflammation or repeated microtrauma from bowel movements leads to vascular congestion.
Genetic and hereditary factors	Family history suggests a genetic susceptibility to weakened blood vessels and tissue.

Table 1.
Key mechanisms in pathophysiological theories.

of blood vessels within the anal canal and rectum. Hemorrhoids are thought to originate primarily from the vascular cushions present within the anal canal, which play a crucial role in maintaining anal continence and preventing leakage of stool and gas. Several risk factors, including pregnancy, elderly age, constipation, chronic diarrhea, and internal rectal prolapse, have been reported to be associated with the formation of hemorrhoids [2]. While the exact etiology remains multifactorial and not fully elucidated, several key mechanisms have been proposed in **Table 1**.

3. Current management of hemorrhoids

The management of hemorrhoids spans from making adjustments to one's diet and lifestyle to undergoing extensive surgery, with the chosen approach contingent upon the extent and seriousness of the symptoms. Treatments can be grouped into three categories namely conservative, office-based, and surgical [3].

3.1 Lifestyle modification

Lifestyle modifications and dietary factors should be advised as primary and preventive measures for patients with any degree of hemorrhoids. They are as follows: [2, 4, 5]

- Increase in the dietary fiber consumption
- Ensure adequate water and fluid intake
- Reduce the consumption of fat
- Warm sitz bath is recommended
- Daily physical exercise for 20–30 minutes
- Maintain proper anal hygiene
- Sit on the toilet with resting feet six-inch high from surface
- Abstain straining and reading on the toilet
- Avoid medicines that cause constipation or diarrhea

3.2 Fiber supplement

The recommended intake of dietary fiber for adults is 25 g/day (women) to 30 g/day (men) [6]. Fiber helps in maintaining stool consistency, preventing it from becoming overly hard or loose [7]. Fiber supplementation has shown an effective beneficial effect in the treatment of symptomatic hemorrhoids. In studies with multiple intervals of follow-up, results indicated positive outcomes associated with fiber supplementation concerning issues like prolapse, pain, and itching [8].

3.3 Non-operative treatment

3.3.1 Sclerotherapy

Sclerotherapy, using agents like phenol in oil, vegetable oil, quinine, or hypertonic salt solution, is a recommended treatment for first and second-degree hemorrhoids. The precise injection into the submucosa at the hemorrhoidal tissue aims to induce fibrosis, fixing the mucosa to the underlying muscle [2].

3.3.2 Rubber band ligation

Rubber band ligation is an effective treatment for first- and second-degree hemorrhoids as well as a few cases of third-degree hemorrhoids. Reduced blood supply causes ischemic necrosis and subsequent scarring of the hemorrhoidal tissue, ending in fixation to the rectal wall. Multiple anal locations can be treated at once. Severe pain can be avoided by carefully placing the band, particularly near the dentate line. Sitz baths and analgesics may help in alleviating the pain [2].

4. Need for a natural alternative

The need for an oral dietary supplement for the treatment of hemorrhoids arises from several key factors and considerations in the management of this common and often uncomfortable medical condition:

Prevalence and impact: hemorrhoids are highly distressing and frequently observed an anorectal condition, involving half of the population at some stage in their lives [9]. This high prevalence underscores the need for accessible and effective treatment options.

Variability in severity: hemorrhoids can range from mild discomfort to severe pain and bleeding. Most common complications vary from heavy bleeding, chronic unremitting prolapse of mucosal tissue, and ulceration, to thrombosis [10]. Despite centuries of treating this condition, its precise etiology is unclear and thus, a definitive treatment has yet to be established [11]. The severity of symptoms varies among individuals, and treatment should be tailored to the specific needs of each patient. An oral dietary supplement can provide a non-invasive and potentially versatile option for a wide range of patients.

Minimizing invasiveness: many treatment options are proposed for the management of hemorrhoids. Dietary interventions, lifestyle modification and medication treatment are adopted but surgical procedures or office-based interventions such as rubber band ligation are normally utilized [11]. These can be painful and associated with potential complications. Many patients thus prefer less invasive treatment options that can be administered orally.

Managing chronic symptoms: hemorrhoids can become a chronic condition for some individuals, requiring long-term management. An oral supplement may offer the advantage of sustained and convenient treatment over extended periods, potentially reducing the recurrence of symptoms.

Holistic approach: many times, patients are interested in holistic and natural approaches to healthcare. Dietary supplements made from natural compounds like catechin, epicatechin, etc. align with this preference for non-pharmaceutical, plant-based interventions.

Potential health benefits beyond hemorrhoids: these dietary supplements often contain bioactive compounds with broader health benefits. Catechin and epicatechin, for example, are known for their antioxidant and anti-inflammatory properties and may provide additional health advantages, making them attractive options for individuals looking to enhance overall well-being.

Patient preferences: patient preferences and adherence to treatment regimens are crucial for successful outcomes. An oral dietary supplement is typically more convenient and easier to incorporate into daily life than other treatment modalities.

In conclusion, the need for an oral dietary supplement for the treatment of hemorrhoids is driven by the desire to provide patients with effective, non-invasive, and versatile options for managing this prevalent and sometimes chronic condition. Such supplements have the potential to address underlying causes, reduce the invasiveness of treatment, and align with patients' preferences for holistic and natural approaches to healthcare.

5. Naturally available phytochemicals

Hemorrhoids involve the initiation of physiological and pathological changes by free radicals. Antioxidants play a key role in managing hemorrhoids by neutralizing these free radicals, contributing to their eradication. A vital but often overlooked aspect of therapy for hemorrhoids is the use of botanical and nutritional approaches. Herbal medicines have shown efficacy in enhancing vascular tone, microcirculation in the perivascular amorphous substrate, strengthening connective tissue, and improving capillary flow [12].

Moreover, herbal extracts containing phyto-antioxidants such as polyphenols, flavonoids, tannins, and related compounds are recognized for their favorable impact on health, leading to a decreased occurrence of diseases. Consequently, there is a considerable emphasis on exploring natural antioxidants, aiming to deliver substantial health advantages with minimal associated toxicities [13].

5.1 Phytochemicals used in the treatment of hemorrhoids

Based on different chemical structural groups, phytochemicals are categorized into phenolics, flavonoids, alkaloids, plant steroids, terpenes, lignans, saponins and glycosides.

Flavonoids, known for their antioxidant, anti-inflammatory, anti-mutagenic, and anti-carcinogenic properties, are associated with a diverse range of health-enhancing effects. They serve as essential components in various applications, including nutraceuticals, pharmaceuticals, medicinal products, and cosmetics.

5.1.1 Flavonoids

Flavonoids, naturally occurring compounds with different phenolic contents, are present in bark, roots, stems, flowers, and fruits. The different flavonoids like flavones, isoflavones, neoflavonoids flavonols, flavanones, flavanonols, flavanols or catechins, and anthocyanins, are categorized based on their ring position. The antioxidant activity of the flavonoids is related to the degree of unsaturation, and oxidation of the rings [14].

Flavonoids like proanthocyanidins comprising catechins and epicatechins have Flavanols, a subgroup of flavonoids, present as stereoisomers in cis or trans

configuration [(−)-epicatechin (cis) and (+)-catechin], have been reported with free radical scavenging, antioxidant, anti-inflammatory and anti-allergic activity [15]. A meta-analysis of flavonoids for hemorrhoidal treatment suggested that flavonoids decreased the risk of bleeding, persistent pain and itching, and also reduced the recurrence rate [16].

5.1.2 Catechin and epicatechin

Proanthocyanidins are a type of flavonoids that include procyanidins [17]. They are oligomeric flavonoids and polymers of flavan-3-ols, mainly catechin and epicatechin [18].

Catechins, diverse isoforms of polyphenol compounds within the flavonoid family, consist of two steric forms: (+)-catechin and its enantiomer. These include compounds like epigallocatechin gallate, epigallocatechin, and epicatechin gallate [19].

Currently, catechin and epicatechin have garnered significant interest due to their status as non-toxic, plant-derived natural antioxidants that effectively neutralize free radicals within the human body [20].

5.2 How do they act?

Flavonoids are a group of plant compounds known for their antioxidant properties. Research suggests that various types of flavonoids, including flavones and catechins, exhibit strong antioxidant activity, and protect the body against reactive oxygen species [14]. Proanthocyanidins (catechins and epicatechins) may act via the following mechanisms:

- Proanthocyanidins crosslink the collagen fibers in the vessel basement membranes which makes them stronger and less permeable.
- The proanthocyanidins or monomeric catechins increase plasma antioxidant activity and also show beneficial effects on capillary fragility and permeability.
- Inhibition of enzymes such as hyaluronidase, elastase and collagenase which degrade the connective tissue leads to increased capillary permeability.
- Proanthocyanidins prevent the release and synthesis of compounds associated with inflammation and allergies such as histamine, serine proteases, prostaglandins and leukotrienes.
- They carry vitamin C to the basement membranes which leads to increased production of collagen making vessels (veins) strong.

5.3 Published literature

Throughout history, the community has relied on traditional remedies derived from plants and herbs to address hemorrhoids. The World Health Organization promotes the exploration of herbal medicines rooted in traditional wisdom [21]. Nevertheless, for these herbal treatments to gain acceptance within modern medicine, they must be substantiated by scientific evidence. The comprehensive details of natural sources and their phytochemical activity in hemorrhoids are given in **Table 2**.

Sr. no.	Plant name	Phytoconstituents	Pharmacological activity
1	*Achillea biebersteinii Afan* [22]	Flavonoids, tannins	Antioxidant
2	*Achillea millefolium L.* [23]	Flavonoids, tannins	Antispasmodic, anti-inflammatory, anti-hemorrhoidal
3	*Achillea wilhelmsii K.Koch* [3]	Flavonoids, tannins	Antioxidant, anti-inflammatory
4	*Anthemis austriaca Jacq* [5]	Flavonoids	Antioxidant
5	*Anthemis pseudocotula Boiss* [8]	Tannins, Flavonoids	Antioxidant and Anti-inflammatory
6	*Arum balansanum R.R. Mill* [24]	Alkaloids, polyphenols, glycosides (flavonoids, saponin and cyanogenic groups), monoterpenes, sesquiterpenes, lectin	Anti-hemorrhoidal
7	*Arum elongatum steven ssp.* [24]	Alkaloids, polyphenols, glycosides (flavonoids, saponin and cyanogenic groups), monoterpenes, sesquiterpenes, lectin	Anti-hemorrhoidal
8	*Arum maculatum L.* [25]	Alkaloids, polyphenols, glycosides (flavonoids, saponin and cyanogenic groups), monoterpenes, sesquiterpenes, lectin	Anti-hemorrhoidal
9	*Commiphora molmol* [26]	Flavonoids	Anti-inflammatory, anti-hemorrhoidal
10	*Commiphora mukul* [27]	Flavonoids, terpenes, phytosterols	Anti-hemorrhoidal, astringent antiseptic, anti-inflammatory, demulcent
11	*Dracunculus vulgaris Schott* [28]	Saponins, tannins, Flavonoids	Treatment of hemorrhoids
12	*Eryngium campestre L.* [29]	Flavonoid	Anti-hemorrhoidal
13	*Gardenia gummifera* [30]	Flavonoids	Antioxidant, anti-inflammatory
14	*Mesua ferrea* [31]	Flavonoids	Anti-inflammatory, anti-ulcer, and anti-microbial
15	*Opopanax hispidus Friv. Gris* [32]	Flavonoids	Antioxidant, anti-hemorrhoidal
16	*Petroselinum crispum Miller* [33]	Flavonoids	Antioxidant, anti-inflammatory
17	*Sambucus ebulus L* [34, 35]	Flavonoids, Tannins	Antioxidant, anti-inflammatory, anti-hemorrhoidal
18	*Sambucus nigra L.* [36]	Flavonoids	Anti-hemorrhoidal
19	*Tagetes erecta* [37]	Flavonoids	Wound healing, antioxidant, analgesic

Table 2.
Natural sources and their phytochemical activity in hemorrhoids.

6. Conclusion

Anorectal disorders, including hemorrhoids, pose a significant medical challenge due to their impact on quality of life and the complex interplay of biological, psychological, and sociocultural factors. Hemorrhoids, a common condition affecting the anal canal's blood vessels, are associated with oxidative stress, making natural antioxidants like flavonoids, catechins, and epicatechins an appealing treatment option.

This review emphasizes the need for a natural alternative in hemorrhoid treatment, focusing on the potential of phytochemicals to combat oxidative stress. In summary, these natural antioxidants show promise in alleviating hemorrhoidal symptoms and improving anal canal health, offering a valuable addition to treatment options for this common condition.

Conflict of interest

The authors declare no conflict of interest.

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