PROFESIONAL HEALTH JOURNAL
Volume 8, No. 1, December 2026 (Page. 179-191)
Available Online at https://www.ojsstikesbanyuwangi.com/index.php/PHJ/index
E-ISSN 2715-6249
DOI: https://doi.org/10.54832/phj.v8i1.1190

Literature Review : The Role of Polyphenols in Modulating Gut Microbiota and Their Anti-Inflammatory Effects on *Inflammatory Bowel Disease* (IBD)

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ARTICLE INFORMATION

Article history
Received (18 April 2025)
Revised (27 August 2025)
Accepted (9 January 2026)

Keywords
Polyphenols, gut microbiota, anti-inflammatory, inflammatory bowel disease, literature review

ABSTRACT

Introduction: *Inflammatory Bowel Disease (IBD) is a chronic, idiopathic disorder of the gastrointestinal tract marked by persistent inflammation. The prevalence of IBD in Southeast Asia has increased from 103,000 cases in 2017 to nearly 118,000 cases in 2020. Dietary patterns play a significant role in the onset and progression of IBD. Polyphenols, bioactive compounds in plant-based foods, interact, act on molecular pathways to inhibit inflammation and protect against oxidative stress. Additionally, polyphenols modulate the gut microbiota, promoting the growth of beneficial bacteria.*
Objectives: *The study aimed to review the therapeutic potential of polyphenols from various food sources in reducing inflammation and enhancing gut microbiota diversity as a potential therapeutic approach for IBD.*
Methods: *This study used a literature review method, analyzing experimental in vivo studies. Data were collected by searching for published articles in ScienceDirect, Google Scholar, and PubMed.*
Results: *Eight studies were identified discussing the role of polyphenols in IBD. Polyphenols from various sources, including camellia oil, EGCG from green tea, resveratrol, kiwi polyphenol extract, curcumin, luteolin, bee pollen, and flavonoids, were found to have positive effects on modulating gut microbiota composition and reducing inflammation in animal models of IBD.*
Conclusions: *Polyphenols have potential as a therapeutic agent for IBD by inhibiting inflammation and promoting gut microbiota diversity.*

Introduction

Inflammatory bowel disease (IBD) is an idiopathic disease caused by chronic inflammation that occurs in the digestive tract. This type of disease is divided into *ulcerative colitis* (UC) and *Crohn's disease* (CD) (Rubin et al., 2012). CD is defined as a transmural segmental disease that can occur in any part of the digestive tract, whereas UC occurs only in the rectum and colon, spreading upwards gradually and affecting only the mucosal and submucosal layers (Ruiz Castro et al., 2021). In the 21st century, IBD has emerged as a global health problem, with a particularly rapid increase in incidence observed in developing nations, largely attributed to the adoption of westernized lifestyle (Ng et al., 2017). The number of IBD cases in Southeast Asia has increased from 103.000 cases in 2017 to nearly 118.000 in 2020 (Olfatifar et al., 2021). In Indonesia, the incidence rate of UC was reported as 0.55 per 100,000 population, while CD had an incidence rate of 0.33 per 100,000 population according to a study published in 2016 (Ng et al., 2016). Another study involving 13 countries across the Asia-Pacific region, published in 2018, reported that the overall incidence of IBD in Indonesia was 0.77 per 100,000 population, with UC and CD incidence rates of 0.49 and 0.27 per 100,000 population, respectively (Ng et al., 2019). The exact etiology of IBD is not yet known; this disease is related to complex interactions between environmental factors, genetics, infection, immune factors, and microbiota (Kaser et al., 2010). IBD not only

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reduces quality of life due to chronic symptoms such as abdominal pain, diarrhea, and malnutrition, but also imposes a heavy economic burden on patients and healthcare systems (Kaplan, 2015).

The main symptoms that IBD patients often complain about are diarrhea, abdominal pain, bloody stools, and weight loss (Stephanie & Makmun, 2014). According to Lipinwati, (2022), clinical symptoms of IBD consist of intestinal symptoms, extraintestinal symptoms, and systemic symptoms. Intestinal symptoms are symptoms related to the digestive tract, such as chronic diarrhea with or without blood, abdominal pain, nausea, and vomiting, while extraintestinal symptoms are symptoms related to organs or systems outside the digestive tract, such as arthritis, uveitis, pyoderma gangrenosum, erythema nodosum, and cholangitis. Systemic symptoms include anemia, fever, and nutritional disorders. The clinical course of IBD usually starts with gastrointestinal symptoms such as chronic diarrhea, abdominal pain, rectal bleeding, and unintended weight loss. In Crohn's disease, these complaints may appear several years before a definitive diagnosis is made, while in ulcerative colitis, the condition is often identified earlier due to its more consistent and localized colonic symptoms. As the disease progresses, persistent inflammation leads to complications such as fistulas, strictures, and perianal disease in Crohn's disease, or strictures and severe colonic bleeding in ulcerative colitis (Silaghi et al., 2022).

At the onset of IBD, both the innate and adaptive immune systems become activated. Activation of these two systems will result in excessive release of proinflammatory cytokines, such as TNF-α, interleukin 6, (IL-6), and IFN-γ (Holleran et al., 2020). One hypothesis states that there is a contribution of gut microbiota to the incidence of IBD. Genetic susceptibility can cause dysregulation of the mucosal immune system, resulting in an exaggerated immune response against the normal gut microbiota. Moreover, alterations in gut microbiota composition can provoke abnormal responses from the mucosal immune system, ultimately driving intestinal inflammation and the progression of IBD (Strober et al., 2007).

Diet plays an important role in the development of inflammatory bowel disease, or IBD. Consuming high amounts of meat, fat, and polyunsaturated fatty acids will increase the risk of IBD (Hou et al., 2011). In contrast, a diet high in vegetables and fruit is associated with a reduced risk of IBD (Ananthakrishnan et al., 2013). This shows that diet can influence a person's susceptibility to IBD. Therefore, an alternative is needed using food components that have therapeutic potential for IBD. Plant foods naturally contain polyphenols. Polyphenols are a group of biologically active compounds that have a complex structure and can be found in fruits, vegetables, nuts, wheat, coffee, and tea. Polyphenols can be classified into many classes, but the main classes of polyphenols are phenolic acids, flavonoids, stilbenes, phenolic alcohols, and lignans (Abbas et al., 2017). Various studies show that polyphenols have benefits for health and the prevention of diseases such as obesity, cancer, diabetes, cardiovascular disease, and intestinal disease (Liu et al., 2021). Polyphenols have anti-inflammatory, antioxidant, immunomodulatory, and apoptotic properties (Kaulmann & Bohn, 2016). Polyphenols can also increase the body's antioxidant capacity by increasing activity of *superoxide dismutase* (SOD) and *glutathione peroxidase* (GPx) (Sánchez-Rodríguez et al., 2016).

In the event of IBD, polyphenols will interact directly with molecular targets to inhibit the inflammatory process and protect against oxidative stress. In addition, polyphenols will modulate and can increase the growth of intestinal microbiota (Jamieson et al., 2023). Other research suggests that polyphenols can increase the diversity of beneficial gut microbiota while inhibiting potentially pathogenic gut microbiota (Duda-Chodak et al., 2015). Polyphenols can also increase the formation of microbial metabolites including SCFAs, secondary bile acids, and indoles which have diverse effects on intestinal homeostasis (Jamieson et al., 2023).

Various studies have analyzed the influence of polyphenols on gut microbiota diversity and anti-inflammatory effects in IBD. However, the results of this study showed varying results and

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dosage use. Therefore, this research uses the method of *literature review* to examine the potential use of polyphenols from various food sources and their administration doses in modulating gut microbiota and inhibiting inflammation as a therapeutic approach in IBD.

Methods

This research uses a design *literature review* by looking for scientific articles that have been published in the last ten years (2014-2024). The data collection technique in this research was carried out by searching for articles that have been published on *Science Direct, Google Scholar,* and PubMed. Keywords used in article searches are: *Polyphenols, Phenolic acid, Flavonoids, Curcumin, Cathecin, Quercetin, Flavanol, Resveratrol, Gut Microbiota, Intestinal Microbiota, Gut Microflora, Gastrointestinal Microbiota, Anti-inflammatory Inflammatory Bowel Disease, Crohn's Disease, Ulcerative Colitis,* IBD.

The screening process was carried out manually and with the help of the Mendeley application based on inclusion and exclusion criteria. The inclusion criteria for searching for articles used in this research include: 1) Studies with research designs that are in vivo experimental studies, 2) Research that uses polyphenol interventions in various forms, and 3) Articles in English. Meanwhile, the exclusion criteria in this study include: 1) Papers with a research design that is not an experimental study, 2) Research without administering polyphenols as an intervention, 3) There is no *full-text* available, and 4) No full-text available in English.

After selection, a number of articles were obtained that met the inclusion and exclusion criteria. The stages of the search process to obtain suitable articles are presented in the PRISMA *flow diagram*.

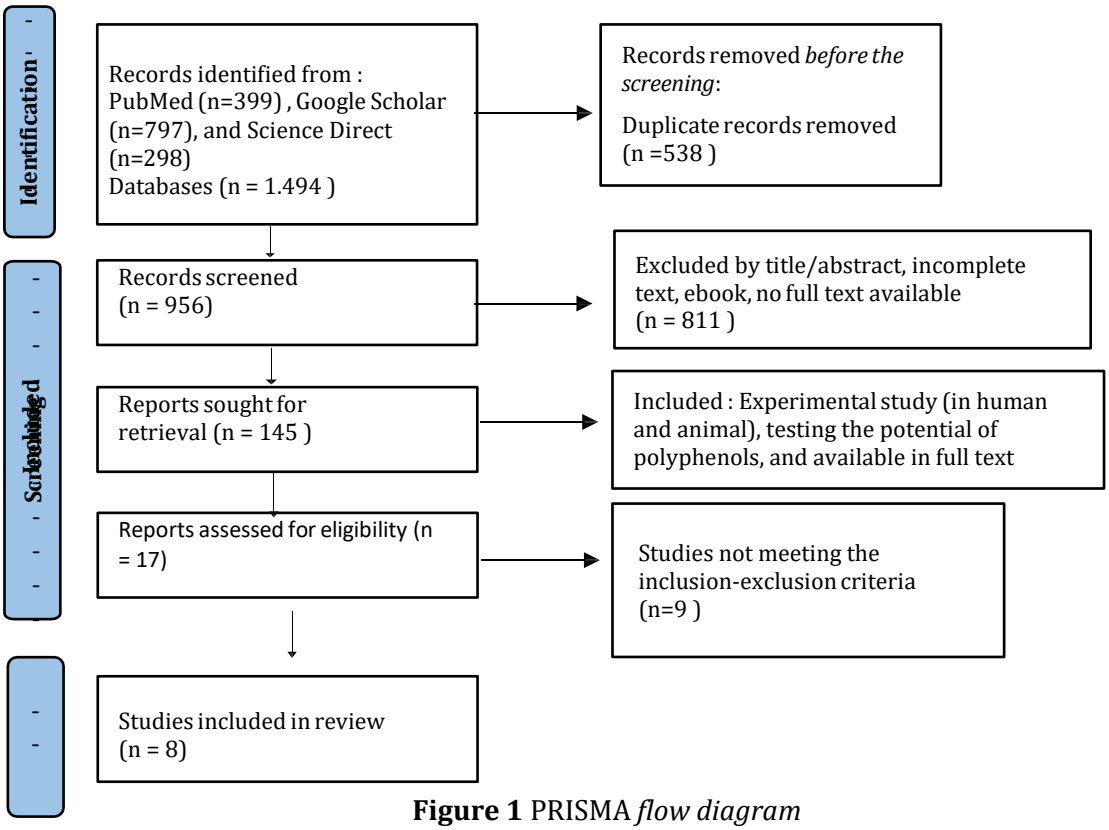

Figure 1 PRISMA *flow diagram*

PROFESIONAL HEALTH JOURNAL
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Results

Article selection using the PRISMA method resulted in 8 articles which will be reviewed through a literature review. The articles were published from 2014 to 2024 and used various forms and doses of polyphenols. The characteristics of each article are summarized in Table 1.

Table 1: List of Selected Research Used in *Literature Review*

Journal Source	Writer	Title	Method	Intervention	Results
Science Direct	Q. Jiang et al., 2023	Camellia oil alleviates DSS-induced colitis in mice by regulating the abundance of intestinal flora and suppressing the NF-κB signaling pathway	4-week-old male ICR mice were divided into five groups and treated with Camellia oil (CO) or sterile water at varying doses for 21 days. From day 14, all mice except the control group were given DSS to induce ulcerative colitis (UC). After the treatment period, colon contents were collected for analysis. Data were analyzed statistically using ANOVA and Tukey's test.	*Camellia oil* 0.5ml/kgBB/day, 1 ml/kgBB/day, 2 ml/kgBB/day	*Camellia oil* has been shown to enhance microbial diversity by increasing beneficial bacteria such as *Bacteroides, Lactobacillus,* and *Odoribacter*, and can reduce the abundance of pathogenic bacteria such as *Alistipes, Lachnospiraceae* NK4136 *group, Ruminococcaceae* UCG-014, and *uncultured Bacteroidales bacterium.*
Springer	Wu, Zhenhua et al., 2021	Gut microbiota from green tea Polyphenol-dosed mice improve the intestinal epithelial homeostasis and ameliorate experimental colitis	Seven- to eight-week-old female C57BL/6 J SPF mice were induced with colitis via 2.5% DSS in drinking water. Mice were divided into six treatment groups, receiving PBS or EGCG orally or rectally for 10 days. Body weight and index. After euthanasia, colon length was measured, and samples of feces, plasma, and colon tissue were collected for analysis. Statistical analysis was performed using SPSS and R software.	EGCG (epigallocatechin-3-gallate) at a dose of 50 mg/kg body weight, administered rectally/orally.	EGCG can reduce colitis and increase the diversity of bacteria producing short-chain fatty acids (SCFA), such as *Akkermansia,* in induced mice

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PubMed Central (PMC)	Fang Li et al., 2020	Dietary Resveratrol Attenuated Colitis and Modulated Gut Microbiota in Dextran Sulfate Sodium-treated mice	40 CD-1 males were divided into four groups (n=10 per group) The groups were: control (standard diet), resveratrol (0.025% resveratrol diet), DSS (1.5% DSS in water), and DSS-resveratrol (0.025% resveratrol diet with DSS). DSS is given for 4 days, followed by 7 days of recovery, repeated four times. Colon tissue was analyzed histologically, and cytokine levels in the colonic mucosa were measured using ELISA. Fecal DNA was extracted for 16S rRNA sequencing to assess microbiota composition. Statistical analysis included ANOVA and Tukey's post hoc test.	Resveratrol 0.025% (w/w)	Resveratrol effectively decreases the abundance of *Akkermansia, Dorea, Sutterella, and Bilophila,* and increases the proportions of *Bifidobacteria* in colitis mice. Attenuated tissue damage and downregulated the expression of pro-inflammatory cytokines in the colon of mice induced with DSS.
Frontiers	Y. Minlan et al., 2021	Supplementation of Kiwifruit Polyphenol Extract Attenuates High-Fat Diet-Induced Intestinal Barrier Damage and Inflammation via Reshaping Gut Microbiome	30 male Sprague-Dawley rats were divided into four groups: normal diet, high-fat diet (HFD), HFD with low-dose KPE (50 mg/kg/day), and HFD with high-dose KPE (100 mg). /kg/day). After 9 weeks, various analyses were performed, including measurement of serum endotoxin, immunohistochemistry of tight junction proteins and TLRs, analysis of microbial diversity via 16S rRNA sequencing, and PCR. Statistical analysis was	High-fat diet with *Kiwifruit polyphenol* low dose (50 mg/kg/day) or high dose (100 mg/kg/day)	Supplementation of KPE at a dose of 50 or 100 mg/kg bw was able to prevent the increase in intestinal permeability induced by HFD. Analysis of microbial diversity and RT-PCR revealed that KPE modulated the gut microbiota, characterized by an increase in beneficial bacteria such as *Lactobacillus* and *Bifidobacterium*, along with a reduction in *Clostridium* and *Desulfovibrionaceae*. KPE supplementation showed anti-inflammatory effects, IL-10 expression

PROFESIONAL HEALTH JOURNAL
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			performed using one-way ANOVA and Tukey's test, with significance set at P < 0.05.		increased and TLR-2, TLR-4, TNF-α and IL-1β expression decreased.
Science Direct	Espley, R.V. et al., 2014	Dietary Flavonoids from Modified Apple Reduce Inflammation Markers and Modulate Gut Microbiota in Mice	"Royal Gala" (RG) apples were genetically modified with the transcription factor MYB10 to increase flavonoid content. Mice were fed a diet including control, GM apple flesh and peel, and MYB10 apple flesh and peel. Health, food intake, urine and feces output, plasma cytokine levels, and colonic microbiota were analyzed. RNA from jejunal tissue was used for gene expression analysis. Statistical analysis was performed using ANOVA with significance set at P < 0.05	RG (Royal Gala) and MYB10 apples at 6 g/mouse per day	In the colonic microbiota, the total number of bacteria in mice fed the MYB-FP diet was 6% higher than in mice not fed the MYB-FP diet. Giving apples high in flavonoids to mice also showed an increase in the number of bacteria, especially *Lactobacillus* and *Bifidobacterium* compared with mice in the control group.
Science Direct	Zhong, Y.B. et al., 2021	Curcumin ameliorated dextran sulfate sodium-induced colitis via regulating the homeostasis of DCs and Treg and improving the composition of the gut microbiota	Male BALB/c mice were induced with 3% DSS and divided into several treatment groups. Curcumin and mesalazine were given orally for seven days. Mice were weighed, and colon tissue was collected for macroscopic, histological, and cytokine analysis. Colonic microbiota diversity was assessed through 16S rRNA gene sequencing. Flow cytometry was used to analyze immune cell populations, and Western blotting was	Curcumin orally at a dose of 100 mg/kg/day	Curcumin administration reduced the colon weight index, and body weight, colon length, and colon tissue inflammation improved significantly; the percentage of Tregs increased significantly, inflammatory DCs and pro-inflammatory cytokines decreased significantly, and the composition of the gut microbiota improved.

PROFESIONAL HEALTH JOURNAL
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			performed to evaluate protein expression in the PI3K/Akt/Raptor/Rictor signaling pathway. Data were analyzed statistically using ANOVA and Mann-Whitney U tests.		
Science Direct	Bolin Li. et al., 2021	Luteolin alleviates inflammation and modulates gut microbiota in ulcerative colitis rats	40 male Wistar rats were divided into four groups. Mice were placed under controlled conditions, acclimatized, and then administered 3.5% DSS solution to induce colitis. After induction of colitis, the control group received saline, while the treatment group received mesalazine or luteolin by gavage. Colon tissue was collected post-sacrifice for histological analysis, immunohistochemistry, ELISA for cytokine levels, and 16S rDNA sequencing to analyze gut microbiota. Disease activity index (DAI) was recorded daily. Data were analyzed statistically using ANOVA and t-test, with $p < 0.05$ considered significant.	Luteolin 34.6 mg/kg/day via gastric probe once a day	Luteolin was shown to markedly alleviate colonic injury and suppress inflammation in UC MICE, as reflected by decreased levels of NF-κB, IL-17 and IL-23 and alongside elevated PPAR-γ. Furthermore, 16S rDNA sequencing analysis revealed that luteolin treatment could alter the diversity and composition of gut microbiota in UC mice. *Lactobacillus, Bacteroides, Roseburia,* and Butyricicoccus are the dominant genera in the luteolin group. Luteolin treatment reduced the increased ratio of *Lactobacillus* and *Prevotella_9.* In addition, KEGG analysis revealed that gut microbiota was mainly associated with DNA repair and recombination of proteins, ribosomes, purine metabolism, peptidases, and pyrimidine metabolism.
Science Direct	Chen, S. et al., 2019	Rape bee pollen alleviates dextran sulfate sodium (DSS)-induced colitis	Mice were divided into control, model, low dose (10.6 g/kg), and high dose (21.2 g/kg) RBP extract groups. Colitis in mice	Low dose RPE (10.6 g/kg BW) and high dose RPE (21.2 g/kg BW)	Administration of RPE at high doses (21.2 g/kg BW) and low doses (10.6 g/kg BW) was shown to alleviate DSS-induced colon

PROFESIONAL HEALTH JOURNAL
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	by neutralizing IL-1β and regulating the gut microbiota in mice	was induced with DSS. Then, the colon tissue and contents were analyzed to determine histological changes, inflammatory mediators, gene expression, and intestinal microbiota composition using various biochemical tests, H&E staining, real-time RT-PCR, and 16S rDNA sequencing. Statistical analysis was performed to determine the significance of the RBP effect, with $p < 0.05$ considered significant.	conditions by improving colon shortening, spleen swelling, and decreasing colon weight. Apart from that, RPE also improves the structure of colonic villi, gland structure, and crypts. Additionally, RPE helped restore the composition of the intestinal microbiota in mice with colitis, marked by a reduction in Allobaculum and Bacteroides, along with a significant increase in Lactobacillus abundance.

Discussion

The gut microbiota maintains a mutualistic relationship with the human host, where the host provides a nutrient-rich environment and shelter for the microbiota, while the gut microbiota contributes to gut health through essential physiological functions. Under normal conditions, it acts as a regulator of homeostasis by fermenting undigested complex polysaccharides, producing short-chain fatty acids (SCFAs), synthesizing certain vitamins, generating energy, preserving intestinal mucosal integrity, and protecting against pathogenic microorganisms (Khan et al., 2019). However, immune system disorders caused by dysbiosis or changes in the composition and function of the gut microbiota will increase inflammation in the digestive tract and cause IBD (Santana et al., 2022). *Inflammatory bowel disease* (IBD) or inflammatory bowel disease is an inflammatory disease caused by immune disorders that arise from complex interactions between genetic factors, the environment, such as diet and stress, and the intestinal microbiota (Kaser et al., 2010). The pattern of dysbiosis associated with IBD patients is a decrease in the diversity of commensal bacteria, especially in *Firmicutes* and *Bacteroides,* and there is an increase in pathogenic bacteria such as *Enterobacteriaceae* (Khan et al., 2019). Other research also states that there is an overall decrease in the number of species and a decrease in the diversity of gut microbiota in IBD sufferers (Qin et al., 2010).

Polyphenols are a group of biologically active compounds that have complex structures and can be found in fruits, vegetables, nuts, wheat, coffee, and tea (Abbas et al., 2017). Polyphenols have also been shown to modulate the intestinal microbiota profile and maintain intestinal microbiota homeostasis, thereby demonstrating the prebiotic properties of polyphenols (Aravind et al., 2021). The prebiotic effects of polyphenols are mostly related to the growth of probiotics or the suppression of pathogenic bacteria, thereby helping to reduce the production of endotoxins, which can trigger pro-inflammatory responses in the intestine (Roberfroid et al., 2010).

PROFESIONAL HEALTH JOURNAL
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E-ISSN 2715-6249
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The results of the literature review presented in Table 1 show that polyphenols come from various sources such as *camellia* oil, EGCG from green tea, resveratrol, kiwi polyphenol extract, curcumin, luteolin, bee pollen, and flavonoids, have a positive impact in modulating the composition of the gut microbiota in animal models with *Inflammatory bowel disease* (IBD).

Each type of polyphenol has a specific mechanism of action in modulating gut microbiota and alleviating IBD symptoms. In the research of Jiang et al. (2023), it was found that *Camellia oil* can increase bacterial diversity, *Bacteroides, Lactobacillus,* and *Odoribacter*, and can reduce the abundance of pathogenic bacteria such as *Alistipes, Lachnospiraceae* NK4136 *group, Ruminococcaceae* UCG-014, and *uncultured Bacteroidales bacterium*. Giving apples high in flavonoids to colitis mice also showed an increase in the number of bacteria by 6%, especially *Lactobacillus* and *Bifidobacterium,* compared to mice in the control group (Espley et al., 2014).

In addition, consumption of resveratrol (0.025% w/w in food) has been shown to inhibit microbiota dysbiosis caused by dextran sodium sulfate (DSS) in mice by increasing the amount of *Bifidobacterium* in feces and decreasing the amount of *Dorea, Sutterella,* and *Bilophila* (Li, F et al., 2018). This is not much different from research by Chen et al., (2019) which shows that administration of RPE can improve the structure of colonic villi, gland structure and crypts. And changing the composition of the gut microbiota in colitis mice, by reducing the abundance of *Allobaculum* and *Bacteroides*, as well as increasing the abundance of *Lactobacillus* significantly. An increase in probiotics or good microbiota and a decrease in pathogenic bacteria will create homeostasis in the intestine, resulting in a balance between bacteria that act as anti-inflammatory and bacteria that have pro-inflammatory potential (Alam & Neish, 2018). Probiotics, such as *Bifidobacterium,* have been shown to affect immune system function due to inflammation of the intestinal mucosa (Yoo & Kim, 2016).

Increasing good gut microbiota can produce various metabolites to prevent invasion of pathogenic bacteria and improve intestinal homeostasis (Deleu et al., 2021). Epigallocatechin-3-gallate (EGCG) is a type of polyphenol found as the main bioactive component of green tea. EGCG can reduce colitis and increase the diversity of bacteria producing short-chain fatty acids (SCFA) such as *Akkermansia* in DSS-induced mice (Wu et al., 2021). Plus, it's a gift, *camellia oil* in mice with colitis, it was also shown to increase SCFA production in *Bacteroides, Lactobacillus,* and *Odoribacter* (Jiang et al., 2023). SCFA are known to have anti-inflammatory effects in the intestine and play a role in maintaining the balance of the anaerobic environment of the intestinal microbiota by balancing oxidation-reduction reactions (Den Besten et al., 2013). The direct effect of butyrate or a mixture of short-chain fatty acids (SCFAs) via enema showed clinical and histological improvement in patients with active ulcerative colitis and diverticulitis colitis (Venegas et al., 2019). At the molecular level, butyrate enema reduces nuclear translocation of NF-κB in lamina propria (LP) macrophages in tissue sections from patients with *ulcerative colitis* distal, as well as on lipopolysaccharide (LPS)-induced cytokine expression and NF-κB activation in LP mononuclear cells and PBMCs from Crohn's (CD) patients (Segain et al., 2000).

In addition to enhancing gut microbiota diversity, this review also highlights the anti-inflammatory properties of polyphenols in IBD. For example, luteolin was shown to markedly reduce colonic injury and suppress inflammation in UC mice. These effects were associated with decreased expression of inflammatory markers such as NF-κB, IL-17, and IL-23, alongside an upregulation of PPAR-γ, a transcription factor known for its anti-inflammatory role. (Li et al., 2021). Meanwhile, another form of polyphenol, namely kiwi polyphenol extract, also shows anti-inflammatory effects by increasing the expression of IL-10 and decreasing the expression of TLR-2, TLR-4, TNF-α, and IL-1β (Yuan et al., 2021). Apart from that, curcumin can also regulate the immune system in the event of IBD. Curcumin can inhibit the excessive activity of inflammatory dendritic cells, inhibit the activation of Th17 cells, thereby reducing IL-7 production, and increase

PROFESIONAL HEALTH JOURNAL
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the number and activity of Treg cells through the gut microbiota, so that it can reduce inflammation (Zheng et al., 2023).

Despite the promising evidence, most findings originate from animal studies or in vitro models. The doses of polyphenols used in animal and in vitro studies are often much higher than those achievable through a typical human diet, making it uncertain what concentrations can be consumed both safely and effectively in humans (Kesh & Goel, 2023). Furthermore, the bioavailability of polyphenols is generally low and strongly influenced by factors such as food matrix interactions and metabolic transformations in the gut, which may reduce their therapeutic potential (Bohn, 2014). Future research should prioritize improving bioavailability, establishing standardized protocols to ensure consistency, and conducting human studies at physiologically relevant doses, so that the potential benefits of polyphenols can be more reliably translated into clinical practice to improve health outcomes.

Strengths & Limitations

This article is a literature review that has several strengths and limitations. One of its strengths is the presentation of a comprehensive review of eight in vivo studies selected using the PRISMA method, providing a clear picture of the potential of polyphenols in relieving symptoms of Inflammatory Bowel Disease (IBD). In addition, this literature review also presents an in-depth explanation of the molecular mechanisms of polyphenol compounds, both in modulating the gut microbiota and producing anti-inflammatory effects, which strengthens the quality of the analysis presented. However, there are some limitations in this literature review. The number of studies reviewed is relatively limited, namely only eight articles, so the findings may not fully represent the body of available scientific evidence regarding the role of polyphenols in IBD.

Conclusion

Polyphenols are biologically active compounds that are found in many foods. Polyphenols are known to influence the composition and diversity of gut microbiota and have anti-inflammatory effects. By modulating the microbiota, polyphenols help maintain balance and relieve symptoms of Inflammatory Bowel Disease (IBD). This literature review shows that various forms of polyphenols, such as luteolin, kiwi polyphenol extract, and curcumin, have the effect of alleviating inflammation and regulating the immune system through interactions with gut microbiota. Thus, polyphenols may provide a therapeutic opportunity in managing IBD through modulation of gut microbiota and anti-inflammatory properties.

Acknowledgments

The author would like to thank the researchers and authors whose scientific works have become important references in this literature review. Apart from that, the author also thanks all parties who have provided assistance and support during the process of writing this article.

References

Abbas, M., Saeed, F., Anjum, F. M., Afzaal, M., Tufail, T., Bashir, M. S., Ishtiaq, A., Hussain, S., & Suleria, H. A. R. (2017). Natural polyphenols: An overview. *International Journal of Food Properties*, *20*(8), 1689–1699. https://doi.org/10.1080/10942912.2016.1220393

Alam, A., & Neish, A. (2018). Role of gut microbiota in intestinal wound healing and barrier function. *Tissue Barriers*, *6*(3), 1–22. https://doi.org/10.1080/21688370.2018.1539595

Ananthakrishnan AN, Khalili H, Konijeti GG, Higuchi LM, de Silva P, Korzenik JR, Fuchs CS, Willett WC, Richter JM, Chan AT. Ananthakrishnan AN, Khalili H, Konijeti GG, Higuchi LM, de Silva P,

PROFESIONAL HEALTH JOURNAL
Volume 8, No. 1, December 2026 (Page. 179-191)
Available Online at https://www.ojsstikesbanyuwangi.com/index.php/PHJ/index
E-ISSN 2715-6249
DOI: https://doi.org/10.54832/phj.v8i1.1190

Korzenik JR, Fuchs CS, Willett WC, Richter JM, CA (2013). A Prospective Study of Long-term Intake of Dietary Fiber and Risk of Crohn's Disease and Ulcerative Colitis. *Gastroenterology*, *83*(1), 1–11. https://doi.org/https://doi.org/10.1053/j.gastro.2013.07.050

Aravind, S., Wichienchot, S., … R. T.-F. R., & 2021, undefined. (n.d.). Role of dietary polyphenols on gut microbiota, their metabolites and health benefits. *Elsevier*. Retrieved May 1, 2024, from https://www.sciencedirect.com/science/article/pii/S0963996921000880?casa_token=uUvMCS-lU68AAAAA:RwcfDzr-TMNBgPLaSY7dOUjuVLQGT_6pm_JKw7lFgkA0_Iy61PsrV6irUy-czMl6Rsk7jamAEJpQ

Bohn, T. (2014). Dietary factors affecting polyphenol bioavailability. Nutrition reviews, 72(7), 429-452.

Chen, S., Zhao, H., Cheng, N., & Cao, W. (2019). Rape bee pollen alleviates dextran sulfate sodium (DSS)-induced colitis by neutralizing IL-1β and regulating the gut microbiota in mice. *Food Research International*, *122*(April), 241–251. https://doi.org/10.1016/j.foodres.2019.04.022

Deleu, S., Machiels, K., Raes, J., Verbeke, K., & Vermeire, S. (2021). Short chain fatty acids and its producing organisms: An overlooked therapy for IBD? *EBioMedicine*, *66*. https://doi.org/10.1016/j.ebiom.2021.103293

Den Besten, G., Van Eunen, K., Groen, A. K., Venema, K., Reijngoud, D. J., & Bakker, B. M. (2013). The role of short-chain fatty acids in the interplay between diet, gut microbiota, and host energy metabolism. *Journal of Lipid Research*, *54*(9), 2325–2340. https://doi.org/10.1194/jlr.R036012

Duda-Chodak, A., Tarko, T., Satora, P., & Sroka, P. (2015). Interaction of dietary compounds, especially polyphenols, with the intestinal microbiota: a review. *European Journal of Nutrition*, *54*(3), 325–341. https://doi.org/10.1007/s00394-015-0852-y

Espley, R. V, Butts, C. A., Laing, W. A., Martell, S., Smith, H., McGhie, T. K., Zhang, J., Paturi, G., Hedderley, D., Bovy, A., Schouten, H. J., Putterill, J., Allan, A. C., & Hellens, R. P. (2014). Dietary Flavonoids from Modified Apple Reduce Inflammation Markers and Modulate Gut Microbiota in Mice 1, 2, 3. *The Journal of Nutrition*, *144*(2), 146–154. https://doi.org/https://doi.org/10.3945/jn.113.182659

Holleran, G., Scaldaferri, F., Gasbarrini, A., & Currò, D. (2020). Herbal medicinal products for inflammatory bowel disease: A focus on those assessed in double-blind randomised controlled trials. *Phytotherapy Research*, *34*(1), 77–93. https://doi.org/10.1002/ptr.6517

Hou, J. K., Abraham, B., & El-Serag, H. (2011). Dietary intake and risk of developing inflammatory bowel disease: A systematic review of the literature. *American Journal of Gastroenterology*, *106*(4), 563–573. https://doi.org/10.1038/ajg.2011.44

Jamieson, P. E., Carbonero, F., & Stevens, J. F. (2023). Dietary (poly)phenols mitigate inflammatory bowel disease: Therapeutic targets, mechanisms of action, and clinical observations. *Current Research in Food Science*, *6*(February), 100521. https://doi.org/10.1016/j.crfs.2023.100521

Jiang, Q., Jiang, C., Lu, H., Zhou, T., Hu, W., Ping Tan, C., Feng, Y., Shen, G., Xiang, X., & Chen, L. (2023). Camellia oil alleviates DSS-induced colitis in mice by regulating the abundance of intestinal flora and suppressing the NF-κB signaling pathway. *Journal of Functional Foods*, *108*, 105777. https://doi.org/https://doi.org/10.1016/j.jff.2023.105777

Kaplan, G. G. (2015). The global burden of IBD: from 2015 to 2025. *Nature reviews Gastroenterology & hepatology*, *12*(12), 720-727.

Kaser, A., Zeissig, S., & Blumberg, R. S. (2010). Genes and environment: How will our concepts on

the pathophysiology of IBD develop in the future? *Digestive Diseases*, *28*(3), 395–405. https://doi.org/10.1159/000320393

Kaulmann, A., & Bohn, T. (2016). Bioactivity of Polyphenols: Preventive and Adjuvant Strategies toward Reducing Inflammatory Bowel Diseases - Promises, Perspectives, and Pitfalls. *Oxidative Medicine and Cellular Longevity*, *2016*(c). https://doi.org/10.1155/2016/9346470

Kesh, M., & Goel, S. (2023). Polyphenols: Plant-based Nutraceuticals in Human Health. Polyphenols: food, nutraceutical, and nanotherapeutic applications, 45-66.

Khan, I., Ullah, N., Zha, L., Bai, Y., Khan, A., Zhao, T., Che, T., & Zhang, C. (2019). Alteration of gut microbiota in inflammatory bowel disease (IBD): Cause or consequence? IBD treatment targeting the gut microbiome. *Pathogens*, *8*(3), 1–28. https://doi.org/10.3390/pathogens8030126

Li, F., Han, Y., Cai, X., Gu, M., , Sun, J., , Qi, C., Goulette, T., , Song, M., , Li, Z., , & Xiao, H. (2018). Dietary resveratrol attenuated colitis and modulated gut microbiota in dextran sulfate sodium-treated mice. Food & Function, 11(1), 1063–1073. *Physiology & behavior*, *176*(1), 139–148. https://doi.org/10.1039/c9fo01519a.Dietary

Li, B., Du, P., Du, Y., Zhao, D., Cai, Y., Yang, Q., & Guo, Z. (2021). Luteolin alleviates inflammation and modulates gut microbiota in ulcerative colitis rats. *Life Sciences*, *269*. https://doi.org/10.1016/j.lfs.2020.119008

Lipinwati, L. (2022). Inflammatory Bowel Disease. *Electronic Journal of Scientific Environmental Health And Disease*, *2*(2), 141–147. https://doi.org/10.22437/esehad.v2i2.16919

Liu, F., Li, D., Wang, X., Cui, Y., & Li, X. (2021). Polyphenols intervention is an effective strategy to ameliorate inflammatory bowel disease: a systematic review and meta-analysis. *International Journal of Food Sciences and Nutrition*, *72*(1), 14–25. https://doi.org/10.1080/09637486.2020.1760220

Ng, S. C., Shi, H. Y., Hamidi, N., Underwood, F. E., Tang, W., Benchimol, E. I., Panaccione, R., Ghosh, S., Wu, J. C. Y., Chan, F. K. L., Sung, J. J. Y., & Kaplan, G. G. (2017). Worldwide incidence and prevalence of inflammatory bowel disease in the 21st century: a systematic review of population-based studies. *The Lancet*, *390*(10114), 2769–2778. https://doi.org/10.1016/S0140-6736(17)32448-0

Olfatifar , M. , Zali , M. R. , Pourhoseingholi , M. A. , Balaii , H. , Ghavami , S. B. , Ivanchuk , M. , Ivanchuk , P. , Nazari , S. hashemi , shahrokh , S. , Sabour , S. , Khodakarim , S. , Aghdaei , H. A. , Rohani , P. , & Mehralian , G. (2021). The emerging epidemic of inflammatory bowel disease in Asia and Iran by 2035: A modeling study. *BMC Gastroenterology*, *21*(1), 1–8. https://doi.org/10.1186/s12876-021-01745-1

Qin, J., Li, R., Raes, J., Arumugam, M., Burgdorf, K. S., Manichanh, C., Nielsen, T., Pons, N., Levenez, F., Yamada, T., Mende, D. R., Li, J., Xu, J., Li, S., Li, D., Cao, J., Wang, B., Liang, H., Zheng, H., … Zoetendal, E. (2010). A human gut microbial gene catalog established by metagenomic sequencing. *Nature*, *464*(7285), 59–65. https://doi.org/10.1038/nature08821

Roberfroid, M., Gibson, G. R., Hoyles, L., McCartney, A. L., Rastall, R., Rowland, I., Wolvers, D., Watzl, B., Szajewska, H., Stahl, B., Guarner, F., Respondek, F., Whelan, K., Coxam, V., Davicco, M. J., Léotoing, L., Wittrant, Y., Delzenne, N. M., Cani, P. D., … Meheust, A. (2010). Prebiotic effects: Metabolic and health benefits. *British Journal of Nutrition*, *104*(SUPPL.2). https://doi.org/10.1017/S0007114510003363

Rubin, D. C., Shaker, A., & Levin, M. S. (2012). Chronic intestinal inflammation: Inflammatory bowel disease and colitis-associated colon cancer. *Frontiers in Immunology*, *3*(MAY), 1–10. https://doi.org/10.3389/fimmu.2012.00107

Ruiz Castro, P. A., Yepiskoposyan, H., Gubian, S., Calvino-Martin, F., Kogel, U., Renggli, K., Peitsch, M. C., Hoeng, J., & Talikka, M. (2021). Systems biology approach highlights mechanistic

differences between Crohn's disease and ulcerative colitis. *Scientific Reports*, *11*(1), 1–14. https://doi.org/10.1038/s41598-021-91124-3

Sánchez-Rodríguez, C., Martín-Sanz, E., Cuadrado, E., Granizo, J. J., & Sanz-Fernández, R. (2016). Protective effect of polyphenols on presbycusis via oxidative/nitrosative stress suppression in rats. *Experimental Gerontology*, *83*, 31–36. https://doi.org/10.1016/j.exger.2016.07.005

Santana, P. T., Rosas, S. L. B., Ribeiro, B. E., Marinho, Y., & de Souza, H. S. P. (2022). Dysbiosis in Inflammatory Bowel Disease: Pathogenic Role and Potential Therapeutic Targets. *International Journal of Molecular Sciences*, *23*(7). https://doi.org/10.3390/ijms23073464

Segain, J. P., Raingeard de la Blétière, D., Bourreille, A., Leray, V., Gervois, N., Rosales, C., Ferrier, L., Bonnet, C., Blottière, H. M., & Galmiche, J. P. (2000). Butyrate inhibits inflammatory responses through NFkappaB inhibition: implications for Crohn's disease. *Gut*, *47*(3), 397–403.http://www.ncbi.nlm.nih.gov/pubmed/10940278%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC1728045

Silaghi, A., Constantin, V. D., Socea, B., Banu, P., Sandu, V., Andronache, L. F., ... & Paunica, S. (2022). Inflammatory bowel disease: pathogenesis, diagnosis and current therapeutic approach. *Journal of Mind and Medical Sciences*, *9*(1), 56-77.

Stephanie, A., & Makmun, D. (2014). Current Diagnostic Approach of Inflammatory Bowel Disease. *The Indonesian Journal of Gastroenterology, Hepatology, and Digestive Endoscopy*, *15*(1), 44–51. https://doi.org/10.24871/151201444-51

Strober, W., Fuss, I., Mannon, P., Strober, W., Fuss, I., & Mannon, P. (2007). The fundamental basis of inflammatory bowel disease Find the latest version : Science in medicine The fundamental basis of inflammatory bowel disease. *The Journal of clinical investigation*, *117*(3), 514–521. https://doi.org/10.1172/JCI30587.514

Venegas, D. P., De La Fuente, M. K., Landskron, G., González, M. J., Quera, R., Dijkstra, G., Harmsen, H. J. M., Faber, K. N., & Hermoso, M. A. (2019). Short chain fatty acids (SCFAs)mediated gut epithelial and immune regulation and their relevance for inflammatory bowel diseases. *Frontiers in Immunology*, *10*(MAR). https://doi.org/10.3389/fimmu.2019.00277

Wu, Z., Huang, S., Li, T., Li, N., Han, D., Zhang, B., Xu, Z. Z., Zhang, S., Pang, J., Wang, S., Zhang, G., Zhao, J., & Wang, J. (2021). Gut microbiota from green tea polyphenol-dosed mice improves intestinal epithelial homeostasis and ameliorates experimental colitis. *Microbiome*, *9*(1). https://doi.org/10.1186/s40168-021-01115-9

Yoo, J. Y., & Kim, S. S. (2016). Probiotics and prebiotics: Present status and future perspectives on metabolic disorders. *Nutrients*, *8*(3), 1–20. https://doi.org/10.3390/nu8030173

Yuan, M., Chen, X., Su, T., Zhou, Y., & Sun, X. (2021). Supplementation of Kiwifruit Polyphenol Extract Attenuates High Fat Diet Induced Intestinal Barrier Damage and Inflammation via Reshaping Gut Microbiome. *Frontiers in Nutrition*, *8*(August), 1–15. https://doi.org/10.3389/fnut.2021.702157

Zheng, L. X., Guo, K. E., Huang, J. Q., Liu, M. H., Deng, B. L., Liu, D. Y., Zhou, B. G., Zhou, W., Zhong, Y. B., & Zhao, H. M. (2023). Curcumin alleviated dextran sulfate sodium-induced colitis by recovering memory Th/Tfh subset balance. *World Journal of Gastroenterology*, *29*(36), 5226–5239. https://doi.org/10.3748/wjg.v29.i36.5226