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Review

Pharmacological Potential of Cyperaceae Species in Experimental Models of Gastrointestinal Disorders: A Review

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Abstract

Some species of Cyperaceae are used in the treatment of gastrointestinal disorders by traditional communities in several countries, including Kenya, Nepal, Pakistan, and India. Although these ethnomedicinal uses are being confirmed through in vivo pharmacological trials, many plants in this family still lack scientific investigation. In this context, the present study aimed to review the pharmacological potential of Cyperaceae species in experimental models of gastrointestinal disorders and correlate it with the phenolic compounds and flavonoids present in these plants. The articles were retrieved from different databases, from the first report on the topic published in 1997 to August 2025. A total of 10 Cyperaceae species were identified that showed pharmacological potential against gastrointestinal disorders, including representatives of the genera *Cyperus* (6 spp.), *Fimbristylis* (2 spp.), *Lagenocarpus* (1 spp.), and *Pycreus* (1 spp.). The extracts of these plants demonstrated potential antiulcerogenic, gastroprotective, antidiarrheal, and intestinal anti-inflammatory effects in rodent models of ulcerative colitis, with particular attention on *Cyperus rotundus* L. A diverse array of bioactive compounds were identified in the Cyperaceae family, including luteolin, kaempferol, caffeic acid, quercetin, ferulic acid, rutin, myricetin, gallic acid, chlorogenic acid, apigenin, catechin, and orientin. These phytochemicals have been widely studied in experimental models of gastrointestinal disorders. It is likely that the flavonoids and phenolic compounds identified in Cyperaceae species are related to the pharmacological potential of these plants and can be used in the treatment of gastrointestinal disorders. Additional studies are needed to investigate the pharmacological potential of other Cyperaceae used empirically in traditional medicine for the treatment of diseases affecting the digestive system.

Keywords: gastric ulcer; gastroprotection; digestive system; flavonoids; phenolic compounds

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1. Introduction

Gastrointestinal diseases include various disorders of the digestive system, including gastric ulcers, diarrhea, inflammatory bowel disease, and gastric cancer [1–3]. Worldwide, the prevalence of gastric ulcer cases increased from 6,434,103 in 1990 to 8,090,476 million in 2019 [4]. Regarding the incidence of diarrhea, it is estimated that 1.7 billion cases occur annually among children worldwide, of which 36 million are severe episodes (2% of cases) [1]. The incidence of inflammatory bowel disease has also been a cause for concern over the years. In 2019, there were approximately 4.9 million cases of the disease worldwide, with China and the United States reporting the highest number of cases [5]. These data are concerning, and although several conventional medication approaches are being used to manage gastric disorders, all of them are associated with one or more side effects [6–9].

In this context, the use of medicinal plants and their isolated compounds has become an important alternative to help prevent and treat gastrointestinal disorders [10–12]. Some representatives of the Cyperaceae family have been used to treat gastrointestinal disorders in different regions of the world. This family comprises around 5687 species distributed across 95 genera [13,14]. Traditional preparations based on *Cyperus esculentus* L., *Cyperus conglomeratus* Rottb., and *Cyperus rotundus* L. are used for the treatment and relief of indigestion, constipation, diarrhea, dysentery, abdominal cramps, stomach pain, and other gastrointestinal disorders by local communities in Kenya [15], Arabian Peninsula [16], Nepal [17], Pakistan [18,19], and India [20,21].

These ethnomedicinal uses have been confirmed through scientific investigations into the pharmacological potential of Cyperaceae species in in vivo models of digestive disorders [22–25]. Antiulcer activity has been reported for *C. conglomeratus* [22], *C. rotundus* [23], and *C. alternifolius* L. [26], while antidiarrheal activity has been reported for the species *C. esculentus* [24], *Fimbristylis miliacea* [25], *F. bisumbellata* (Forssk.) Bubani [27], and *C. niveus* Retz. [28]. Chemically, phenolic compounds and flavonoids, such as kaempferol, luteolin, caffeic acid, chlorogenic acid, and rutin, have been identified in *C. rotundus*, *C. esculentus*, *C. conglomeratus*, *C. tegetum*, and *F. miliacea* [22,29–35]. These compounds are well known to represent a promising alternative in the treatment of gastric ulcers [36] and inflammatory bowel disease [37,38].

The current study aimed to review the pharmacological potential of Cyperaceae species using experimental models of gastrointestinal disorders, with a particular focus on correlating their therapeutic effects with the presence of phenolic and flavonoid compounds. Additionally, the study provided a comprehensive assessment of the acute toxicity and biological safety profiles of extracts derived from these species.

2. Methodology

2.1. Databases

The literature was retrieved from Google Scholar, PubMed®, SciELO, ScienceDirect®, and Scopus®. The keywords used in the article searches were as follows: “Cyperaceae AND gastrointestinal disorders”, “Cyperaceae AND digestive problems”, “Cyperaceae AND dysentery”, “Cyperaceae AND diarrhea”, “Cyperaceae AND antidiarrheal”, “Cyperaceae AND ulcerative colitis”, “Cyperaceae AND intestinal anti-inflammatory”, “Cyperaceae AND gastroprotection”, “Cyperaceae AND gastric ulcer”, “Cyperaceae AND antiulcer”, “Cyperaceae AND gastric anti-cancer”, “Cyperaceae AND inflammatory bowel disease”, “Cyperaceae AND anticonstipation”, “Cyperaceae AND phytochemistry”, “Cyperaceae AND flavonoids”, “Cyperaceae AND phenolic compounds”, and “Cyperaceae AND acute toxicity”.

2.2. Inclusion and Exclusion Criteria

Articles that presented specific information on the pharmacological potential of Cyperaceae species in experimental models of gastrointestinal diseases (gastroprotective, antiulcer, antidiarrheal, intestinal anti-inflammatory, anti-gastric cancer, and anticonstipation activities) and evaluations of acute oral toxicity of extracts were selected, covering publications from the first report by Zhu et al. [39] to August 2025. Studies that reported the occurrence of flavonoids and phenolic compounds in species of this family were also included. Review articles, e-books, book chapters, undergraduate theses, Master’s theses, PhD theses, and works published in technical or scientific events were excluded [40]. Furthermore, studies lacking comprehensive data on the evaluation of biological activities or those identifying species solely at the genus level were excluded. The scientific

names of the species were verified on the website World Flora Online (WFO) Plant List (https://wfoplantlist.org/ (accessed on 10 July 2025)).

2.3. Data Screening and Categorization of Information

A total of 38 articles reporting data on the biological activities observed in experimental studies of gastrointestinal diseases and acute toxicity of extracts derived from Cyperaceae species were reviewed and included in this study. The results were described in three categories: (1) Pharmacological potential of Cyperaceae species; (2) Phenolic compounds and flavonoids identified in Cyperaceae species; and (3) Acute toxicity of extracts from Cyperaceae species.

3. Results and Discussion

3.1. Pharmacological Potential of Cyperaceae Species

A total of 10 species of Cyperaceae were investigated for their pharmacological potential against gastrointestinal disorders, with emphasis on the following representatives of the genus *Cyperus*: *C. alternifolius* L., *C. conglomeratus* Rottb., *C. esculentus* L., *C. niveus* Retz., *C. rotundus* L., and *C. tegetum* (*C. pangorei* Rottb.). Additionally, studies were found for species of the genera *Fimbristylis* (2 spp.), *Lagenocarpus* (1 spp.), and *Pycreus* (1 spp.) (Table 1). Although rhizomes are most commonly used in the preparation of extracts, other parts of the plants, such as tubers, leaves, aerial parts, and the whole plant, have also been used. The extracts of these plants were evaluated in different experimental models to assess the antiulcerogenic, gastroprotective, antidiarrheal, intestinal transit, and intestinal anti-inflammatory activities in rodents (Figure 1).

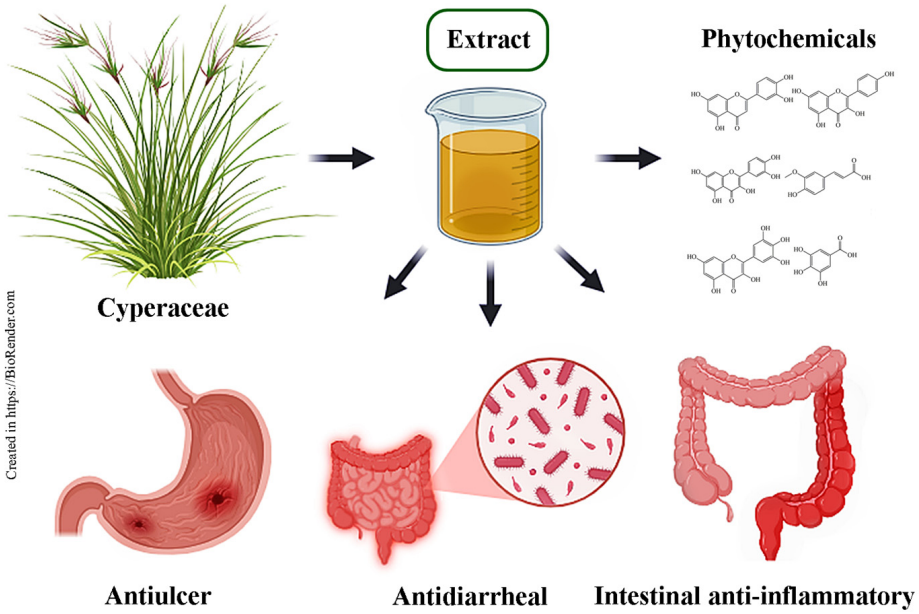


Figure 1. Pharmacological potential of extracts from Cyperaceae species in experimental models of gastric ulcers, diarrhea, and ulcerative colitis. Created in https://BioRender.com.

Cyperus rotundus (Figure 2) was the most studied species regarding its potential for treating gastrointestinal disorders. At doses of 250 and 500 mg/kg, the methanolic extract and the residual methanolic and petroleum ether fractions of *C. rotundus* rhizomes significantly suppressed the frequency of diarrheal episodes in mice [41]. Regarding the potential of the chloroform extract of *C. rotundus* tubers in an experimental model of inflammatory bowel disease, Johari et al. [42] reported that this extract inhibited the gene expression of pro-inflammatory cytokines such as IL-4, IL-6, IL-12, and IFN-γ in the colon tissues of rats.

According to Thomas et al. [43], oral administration of doses of 250 and 500 mg/kg of the methanolic extract of the rhizome of *C. rotundus* significantly inhibited aspirin-induced gastric ulceration in animals in a dose-dependent manner (49.32 and 53.15%, respectively). These authors reported that the extract significantly increased the activity of superoxide dismutase, cellular glutathione, and glutathione peroxidase and inhibited lipid peroxidation in the gastric mucosa of the animals [43]. Rajakrishnan et al. [23] also reported that the gastroprotective activity of the hydroalcoholic extract of *C. rotundus* tubers was proven by increasing the activity of antioxidant enzyme markers, such as catalase and glutathione peroxidase, as well as by reducing lipid peroxidation.



Figure 2. *Cyperus rotundus*. Photos by José Jailson Lima Bezerra.

The antiulcer activity of the species *C. alternifolius* and *C. conglomeratus* was also scientifically evaluated. According to Farrag et al. [26], a significant reduction in the number of gastric ulcers, ranging from 55 to 96%, was observed in the groups treated with doses of 50 and 100 mg/kg of methanolic and ethyl acetate extracts of *C. alternifolius* tubers. Additionally, the authors reported that the methanolic and ethyl acetate extract at doses of 50 and 100 mg/kg significantly reduced TNF-*α* levels by 42, 31, 75, and 69%, respectively, compared to the group treated with indomethacin [26]. In research conducted by Elshamy et al. [22], treatment of rats with an alcoholic extract from the aerial parts of *C. conglomeratus* led to reduced inflammation and the protection of the gastric mucosa from ethanol-induced damage. Furthermore, at a dose of 100 mg/kg, the extract exhibited a 97.1 and 39% reduction in galactin-3 and TNF-*α* levels, respectively, compared to the group treated with ethanol [22].

The antidiarrheal properties of *C. niveus* and *C. esculentus* have been frequently reported in the literature. At doses of 300, 500, and 700 mg/kg, Aleem and Janbaz [28] reported that the hydroethanolic extract of *C. niveus* showed antidiarrheal activity in rats with protection indices of 36, 54.5, and 81.8%, respectively. When evaluated by the intestinal transit method, *C. niveus* extract at doses of 100 and 200 mg/kg decreased the motility of charcoal meal by up to 54.49 and 65.44%, respectively. These antidiarrheal effects were mediated by the dual blockade of muscarinic receptors and Ca^{2+} channels [28]. Shorinwa and Dambani [24] reported that the hydroalcoholic extract of *C. esculentus* tubers inhibited defecation by 46.7 and 40% at doses of 500 and 1000 mg/kg, respectively, by the castor oil-induced diarrhea method in albino rats.

In addition to representatives of the genus *Cyperus*, other species of Cyperaceae also showed antidiarrheal activity. At a dose of 200 mg/kg, Mukta et al. [25] reported that the methanolic extract of the aerial parts of *F. miliacea* showed an evacuation rate and diarrhea inhibition in mice of up to 9.50 and 59.57%, respectively, while the standard drug loperamide exhibited similar results, with rates of 9.83 and 58.16%, respectively. According to Akter et al. [44], the administration of a dose of 400 mg/kg of methanolic extract of *Pycreus polystachyos* in male mice inhibited diarrhea by up to 64.77%. Taken together, these results support the use of Cyperaceae species in traditional medicine in several countries for the treatment of gastrointestinal disorders.

Table 1. Pharmacological potential of extracts from Cyperaceae species in experimental models of gastrointestinal disorders.

Species	Part of the Plant	Extracts	Doses	Methods	Results	References
Cyperus alternifolius L.	Tuber, aerial part	Methanol extract, ethyl acetate extract	50 and 100 mg/kg	Indomethacin-induced gastric ulcer	Extracts from the tubers decreased the severity of gastric ulcers, evidenced by the suppression of TNF-α levels	Farrag et al. [26]
Cyperus conglomeratus Rottb.	Aerial part	Alcoholic extract	25, 50, and 100 mg/kg	Ethanol-induced gastric ulcer	The alcoholic extract significantly reduced galactin-3 and TNF-α and protected gastric epithelial cells in the ethanol-induced ulcer model	Elshamy et al. [22]
Cyperus esculentus L.	Tuber	Hydroalcoholic extract	250, 500, and 1000 mg/kg	Castor oil-induced diarrhea, intestinal transit test with charcoal meal	The hydroethanolic extract appears to have an antisecretory effect, but not an antimotility effect	Shorinwa and Dambani [24]
Cyperus niveus Retz.	Whole plant	Hydroethanolic extract	100–700 mg/kg	Castor oil-induced diarrhea, intestinal transit test with charcoal meal	The hydroethanolic extract showed antidiarrheal effects mediated by the double blockade of muscarinic receptors and Ca^{2+} channels	Aleem and Janbaz [28]
Cyperus rotundus L.	Rhizome	Decoction	1.25, 2.5, and 4.0 g/kg	Ethanol-induced gastric ulcer	The decoction demonstrated a dose-dependent ulcer inhibitory effect	Zhu et al. [39]
	Rhizome	Methanol extract, petrol ether fraction, ethyl acetate fraction, residual methanol fraction	250 and 500 mg/kg	Castor oil-induced diarrhea	The methanolic extract and the residual methanolic and petroleum ether fractions suppressed the frequency of diarrheal episodes in mice	Uddin et al. [41]
	Rhizome	Methanol extract	100 and 200 mg/kg	Gastric mucosal damage induced by ischemia and reperfusion	The methanolic extract affected malondialdehyde and glutathione peroxidase activities and exhibited gastroprotective effect in rats	Güldür et al. [45]
	Rhizome	Ethanolic extract	300 and 500 mg/kg	Aspirin-induced gastric ulcer	The ethanolic extract reduced lesions or hemorrhages in the gastric mucosa of rats, and the results were similar to the cimetidine control	Ahmad et al. [46]
	Rhizome	Methanol extract	250 and 500 mg/kg	Aspirin-induced gastric ulcer	At doses of 250 and 500 mg/kg, the methanolic extract inhibited aspirin-induced gastric ulceration in rats in a dose-dependent manner (49.32 and 53.15%, respectively)	Thomas et al. [43]
	Tuber	Chloroform extract	800 mg/kg	DNBS-induced colitis	The extract inhibited the gene expression of pro-inflammatory cytokines such as IL-4, IL-6, IL-12, and IFN-γ in the colon tissues of rats	Johari et al. [42]
	Tuber	Hydroalcoholic extract	200 and 400 mg/kg	Ulcerogenic and oxidative damage induced by pyloric ligation	The antiulcer potential of the hydroalcoholic extract was attributed to the prevention of the generation of free radical cascades	Rajakrishnan et al. [23]
Cyperus tegetum (*Cyperus pangorei* Rottb.)	Rhizomes	Methanol extract	250, 500, and 750 mg/kg	Castor oil-induced diarrhea, intestinal transit test with charcoal meal	The methanolic extract suppressed the frequency of diarrheal episodes and delayed the intestinal transit of charcoal meal in mice	Chaulya et al. [47]
Fimbristylis bisumbellata (Forssk.) Bubani	Leaves	Aqueous extract	200 and 400 mg/kg	Castor oil-induced diarrhea	The aqueous extract showed a decrease in the number of feces in Wistar rats	Bawazir et al. [27]

Table 1. *Cont.*

Species	Part of the Plant	Extracts	Doses	Methods	Results	References
Fimbristylis miliacea (*Fimbristylis littoralis* Gaudich.)	Aerial part	Methanol extract	100, 200, and 400 mg/kg	Castor oil-induced diarrhea	The methanolic extract showed a strong antidiarrheal effect at doses of 200 and 400 mg/kg	Mukta et al. [25]
Lagenocarpus rigidus (Kunth) Nees	Leaves	Ethanolic extract	6, 60, and 600 mg/kg	Indomethacin-induced gastric lesions	The ethanolic extract protects against indomethacin-induced acute gastric damage in a dose-independent manner	Martins et al. [48]
Pycreus polystachyos (*Cyperus polystachyos* Rottb.)	Whole plant	Methanol extract	100, 200, and 400 mg/kg	Castor oil-induced diarrhea	At a dose of 400 mg/kg, the methanolic extract inhibited diarrhea in male (64.77%) and female (38.04%) mice	Akter et al. [44]

DNBS: dinitrobenzene sulfonic acid.

3.2. Phenolic Compounds and Flavonoids Identified in Cyperaceae Species

A total of 12 phenolic compounds and flavonoids shared among Cyperaceae species were identified (Figure 3). These phytochemicals have been extensively investigated in experimental models of gastric cancer, gastric ulcers, ulcerative colitis, constipation, and diarrhea (Table 2). The flavonoid luteolin, for example, was identified in the species *C. conglomeratus* [22], *F. miliacea* [30], *C. esculentus* [32], and *C. rotundus* [34] and evaluated for its anti-gastric cancer [49,50], anticonstipation [51], antiulcer [52], and intestinal anti-inflammatory potential [53–55].

The anti-gastric cancer activity of the compounds luteolin [49,50], gallic acid [56,57], quercetin [58], apigenin [59], kaempferol [60], myricetin [61,62], catechin [63,64], and rutin [65] has been thoroughly evaluated in in vitro studies. These compounds stood out as promising alternatives to aid in the treatment of gastric cancer. On the other hand, only rutin has been evaluated for its antidiarrheal potential [66]. According to this study, the intake of 500 mg/kg rutin alleviated diarrhea by improving the intestinal barrier, which may be associated with greater antioxidant capacity through the activation of the Nrf2/Keap1 signaling pathway in weaned piglets [66].

The flavonoids kaempferol, quercetin, rutin, apigenin, and orientin exert potent anti-inflammatory activity on ulcerative colitis through multiple mechanisms. According to Qu et al. [67], the flavonoid kaempferol exhibits immunoregulatory effects in mice with ulcerative colitis and suppresses lipopolysaccharide-induced TLR4-NF-κB signaling. Zhang et al. [68] reported that quercetin showed positive effects in an experimental model of ulcerative colitis through the inhibition of PI3K/AKT signaling, restoration of the intestinal barrier, and regulation of the intestinal microbiota, without tissue damage or evident side effects in mice. In a study by Zhao et al. [69], it was observed that rutin exerts anti-inflammatory and antioxidant effects in mice with ulcerative colitis, inhibiting NLRP3 inflammasome signaling. Regarding apigenin, this flavonoid has been reported to improve intestinal immune barrier function, mechanical barrier integrity, and biological barrier function in mice with ulcerative colitis [70]. Sun et al. [71] reported that the oral administration of orientin in mice attenuated experimental inflammatory bowel disease through the suppression of TLR4 and inactivation of the NF-kB and MAPK pathways.

Like flavonoids, the phenolic compounds chlorogenic acid, caffeic acid, ferulic acid, and gallic acid have also been frequently reported for their anti-inflammatory potential in experimental models of ulcerative colitis [72–75]. Regarding their gastroprotective potential, these constituents showed positive effects in experimental models of gastric ulcers. According to Shimoyama et al. [76], chlorogenic acid inhibited neutrophil migration and restored the levels of catalase, superoxide dismutase, glutathione peroxidase, glutathione, and thiobarbituric acid reactive substances in an ethanol/HCl-induced gastric ulcer model

in mice. Kolgazi et al. [77] reported that the oral administration of caffeic acid protected absolute ethanol-induced gastric mucosal damage in rats by preventing neutrophil infiltration, lipid peroxidation, and glutathione depletion. Ermis et al. [78] obtained similar results, in which ferulic acid exhibited gastroprotective effects in rats through the inhibition of neutrophil infiltration, inhibition of the transcription factor NF-κB, suppression of lipid peroxidation, and modulation of antioxidant defense mechanisms. Zhou et al. [79] reported that gallic acid pretreatment significantly elevated the depressed ethanol-induced levels of catalase, superoxide dismutase, and glutathione and reduced the level of thiobarbituric acid reactive substances in gastric tissue in a dose-dependent manner.

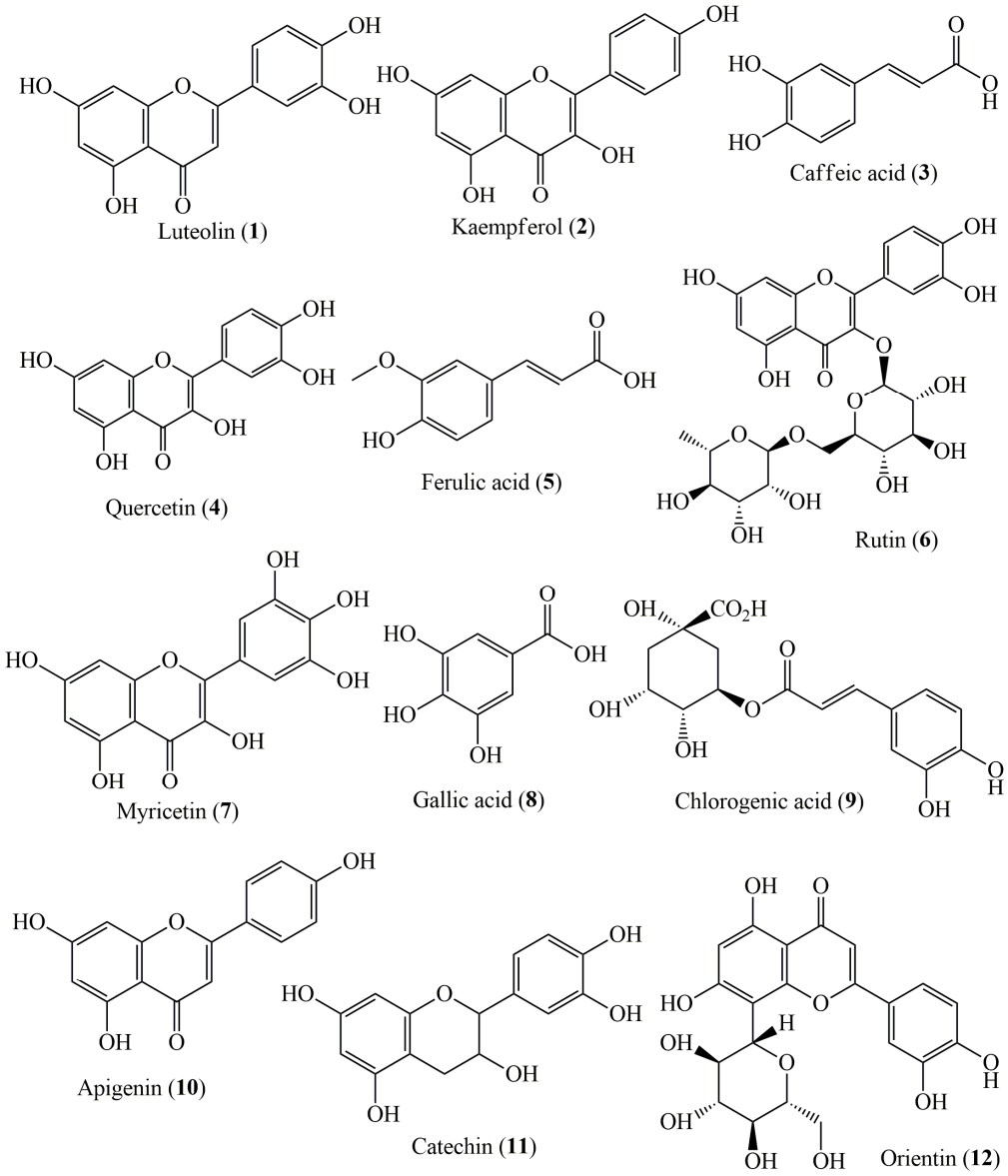


Figure 3. Flavonoids and other phenolic compounds identified in Cyperaceae species. Structures drawn in ChemDraw™.

It is likely that the flavonoids and phenolic compounds identified in Cyperaceae species are directly involved in their potential against gastrointestinal disorders. These substances can act in isolation or synergistically in combination with other constituents that occur in these plants, with emphasis on the terpenoids identified in the underground parts of representatives of this family [40].

Table 2. Flavonoids and other phenolic compounds identified in Cyperaceae species having potential therapeutic effects against gastrointestinal disorders.

Compounds	Species	Biological Activities of Compounds
(**1**) Luteolin	*Cyperus conglomeratus* [22], *Fimbristylis miliacea* [30], *Cyperus esculentus* [32], *Cyperus rotundus* [34]	Anti-gastric cancer activity [49,50], anticonstipation activity in loperamide-induced functional constipation [51], antiulcer activity [52], anti-inflammatory activity on ulcerative colitis [53–55]
(**2**) Kaempferol	*Cyperus alternifolius* [26], *Cyperus rotundus* [29], *Cyperus esculentus* [32], *Fimbristylis miliacea* [33]	Anti-gastric cancer activity [60], antiulcer activity [80], anti-inflammatory activity on ulcerative colitis [67,81–83]
(**3**) Caffeic acid	*Cyperus conglomeratus* [22], *Cyperus tegetum* [31], *Fimbristylis miliacea* [33], *Cyperus esculentus* [35], *Cyperus rotundus* [84]	Anti-inflammatory activity on ulcerative colitis [72], antiulcer activity [77]
(**4**) Quercetin	*Cyperus tegetum* [31], *Cyperus alternifolius* [85], *Cyperus rotundus* [86], *Cyperus esculentus* [87]	Anti-gastric cancer activity [58], antiulcer activity [88,89], anti-inflammatory activity on ulcerative colitis [68,90,91], anticonstipation activity in loperamide-induced constipation [92]
(**5**) Ferulic acid	*Cyperus conglomeratus* [22], *Cyperus rotundus* [86], *Cyperus esculentus* [93]	Antiulcer activity [77,94], anti-inflammatory activity on ulcerative colitis [73,95]
(**6**) Rutin	*Cyperus tegetum* [31], *Cyperus esculentus* [35], *Cyperus rotundus* [96]	Anti-gastric cancer activity [65], antidiarrheal activity [66], anti-inflammatory activity on ulcerative colitis [69], antiulcer activity [97,98]
(**7**) Myricetin	*Cyperus esculentus* [87], *Cyperus rotundus* [99]	Anti-gastric cancer activity [61,62], anti-inflammatory activity on ulcerative colitis [100], antiulcer activity [101]
(**8**) Gallic acid	*Cyperus tegetum* [31], *Fimbristylis miliacea* [33], *Cyperus alternifolius* [85], *Cyperus esculentus* [102]	Anti-gastric cancer activity [56,57], antiulcer activity [79,103], anti-inflammatory activity on ulcerative colitis [75,104]
(**9**) Chlorogenic acid	*Cyperus tegetum* [31], *Cyperus esculentus* [32], *Cyperus rotundus* [105]	Anti-inflammatory activity on ulcerative colitis [74,106], antiulcer activity [76]
(**10**) Apigenin	*Cyperus tegetum* [31], *Cyperus esculentus* [32], *Cyperus rotundus* [107]	Anti-gastric cancer activity [59], anti-inflammatory activity on ulcerative colitis [70], antiulcer activity [108]
(**11**) Catechin	*Fimbristylis miliacea* [33], *Cyperus rotundus* [86], *Cyperus esculentus* [109]	Anti-gastric cancer activity [63,64], antiulcer activity [110]
(**12**) Orientin	*Cyperus rotundus* [111], *Cyperus esculentus* [112]	Anti-inflammatory activity on ulcerative colitis [71]

3.3. Acute Toxicity of Extracts from Cyperaceae Species

Of the 10 Cyperaceae species investigated for their potential against gastrointestinal diseases, only the extracts of *C. niveus*, *F. bisumbellata*, *L. rigidus*, and *P. polystachyos* did not have their toxicity and biological safety reported in the literature. The toxicity of extracts of *C. tegetum*, *C. alternifolius*, *C. conglomeratus*, *C. esculentus*, *C. rotundus*, and *F. miliacea* were evaluated in rodents and showed biological safety when administered at doses ranging from 200 to 5000 mg/kg.

According to Chaulya et al. [47], the methanolic extract of *C. tegetum* rhizomes did not cause the death of mice treated with doses of 100, 200, 400, 800, 1600, and 3000 mg/kg intraperitoneally; however, sedation was observed in the tested animals. Awaad et al. [85] reported that the ethanolic extract of the aerial parts of *C. alternifolius* did not cause behavioral changes or mortality in mice at doses up to 5000 mg/kg. In a study by Al-Hazmi et al. [113], it was observed that different doses of the alcoholic extract of the aerial parts of *C. conglomeratus* (500, 1000, 2000, and 5000 mg/kg) administered orally did not cause any symptoms of acute toxicity and none of the mice died during 24 h of observation. Shorinwa and Dambani [24] reported that some adverse reactions were observed in rats treated with different doses of the aqueous ethanolic extract of *C. esculentus* tubers (1000–5000 mg/kg), including pruritus, sedation, and piloerection. The oral administration of methanolic extract of fresh leaves of *F. miliacea* at single doses of 2000 and 5000 mg/kg did not cause mortality or other adverse effects in mice during an acute toxicity study [114].

Regarding extracts of *C. rotundus*, the species most studied for its pharmacological properties in gastrointestinal disorders (Table 1), no signs of toxicity were observed in rats. According to Johari et al. [42], the chloroform extract of *C. rotundus* tubers did not affect the hematological and biochemical parameters of rats treated with a dose of 1800 mg/kg. Renal and liver functions, serum glucose levels, and the lipid profile of the animals were also not affected. The histopathological findings of the rat organs were similar between

the control and treated groups, indicating that the administration of the extract did not result in any adverse toxicological effects [42]. Rajakrishnan et al. [23] also reported that the hydroalcoholic extracts of *C. rotundus* at doses of 175, 550, and 2000 mg/kg were safe and did not show any mortality or other negative effects on the appearance and behavior of the experimental rats.

4. Gaps

To date, investigations into the pharmacological properties of Cyperaceae species extracts have been limited to evaluating their gastroprotective and antidiarrheal activities in vivo. Methanol, a solvent recognized for its toxicity, has been commonly employed in the preparation of these extracts. Although rotary evaporation is used to eliminate solvents, residual traces of methanol potentially hazardous to health may persist in the final extract [115]. Therefore, water or ethanol is considered more appropriate and safer alternatives for extract preparation in biological assays conducted both in vitro and in vivo.

Only one article was found on the intestinal anti-inflammatory potential of the chloroform extract of *C. rotundus* tubers in an experimental model of ulcerative colitis induced by DNBS [42]. It is necessary to expand studies with these species to investigate their effects in other experimental models, including gastric cancer (MTT method to evaluate cell proliferation in cancer cell lines), constipation (loperamide-induced functional constipation model in rodents), and gastritis (model of gastritis induced by *Helicobacter pylori* infection in rodents).

Despite scientific evidence in experimental models of gastric ulcers, diarrhea, and intestinal inflammation, extracts from Cyperaceae species have not yet been evaluated in patients diagnosed with diseases affecting the digestive system. This gap may be related to some important obstacles involving the clinical use of plant-derived products, such as the determination of a safe and effective dosage, quality control and product standardization, toxicity risks, drug interactions, and adverse effects. In the literature, only three reports of randomized clinical trials were found that evaluated the effects of essential oils and extracts of *C. rotundus* on the treatment of axillary hyperpigmentation [116] and obesity [117,118].

In traditional medicine, other Cyperaceae species such as *Kyllinga polyphylla* [119], *Kyllinga triceps* [120], *Kyllinga brevifolia* [121], *Kyllinga nemoralis* [122], *Kyllinga odorata* [123], *Rhynchospora corymbosa* [124], and *Rhynchospora colorata* [125,126] are used to treat digestive problems such as dysentery, diarrhea, gas, and indigestion. Based on this information, the genera *Kyllinga* and *Rhynchospora* may represent a source of bioactive compounds potentially effective against diseases affecting the digestive system. However, it is important to highlight that, to date, no study has investigated the pharmacological potential of these plants in experimental models of gastrointestinal diseases.

5. Conclusions and Future Perspectives

Extracts obtained from Cyperaceae species showed antiulcerogenic, gastroprotective, antidiarrheal, and intestinal anti-inflammatory activities in ulcerative colitis in rodents, with emphasis on the species *Cyperus rotundus.* It is likely that the flavonoids and phenolic compounds identified in these plants are directly involved in their pharmacological potential against gastrointestinal disorders.

It is important to highlight that the Cyperaceae family comprises approximately 5687 species, but only 10 have been investigated in experimental models of gastrointestinal disorders. In this context, additional studies are needed to investigate and confirm the pharmacological potential of other Cyperaceae used empirically in traditional medicine to treat diseases affecting the digestive system. Pharmacokinetic and toxicokinetic studies of products obtained from these plants are also necessary to assist in the planning and

development of new herbal drugs with gastroprotective, antidiarrheal, and intestinal anti-inflammatory activity.

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