QUALITY IN SPORT
*eISSN 2450-3118 · Open Access · Peer-reviewed*
apcz.umk.pl/QS Nicolaus Copernicus University in Toruń

**Cite as: JANISZEWSKA, Anna, KOŁKOWSKI, Wiktor, JAKUBCZYK, Jan, WĄDOŁOWSKA, Monika, ANTOSZEWSKA, Magdalena, GRABOWSKA, Maria, GOZDERA, Katarzyna, KOSZEWSKI, Jakub, PIELAK, Wiktoria and OSZAST, Katarzyna. Use of alginates in gastroesophageal reflux disease in children – effectiveness and practical considerations: a narrative review. Quality in Sport. 2026;59:72639. https://doi.org/10.12775/QS.2026.59.72639**

**ARTICLE TIMELINE**
Received: 26.05.2026. Revised: 20.06.2026. Accepted: 20.06.2026. Published: 21.06.2026.

The journal has been awarded 20 points in the parametric evaluation by the Polish Ministry of Higher Education and Science (Annex to the announcement of 05.01.2024, No. 32553). Unique Journal Identifier: 201398. Scientific disciplines: Medical Sciences; Health Sciences.
Punkty Ministerialne z 2019 – aktualny rok 20 punktów. Załącznik do komunikatu Ministra Szkolnictwa Wyższego i Nauki z dnia 05.01.2024 Lp. 32553. Posiada Unikatowy Identyfikator Czasopisma: 201398. Przypisane dyscypliny naukowe: Nauki medyczne; Nauki o zdrowiu. 

# Use of alginates in gastroesophageal reflux disease in children – effectiveness and practical considerations: a narrative review

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# Abstract

**Background**

Gastroesophageal reflux disease (GERD) is a common condition in pediatric populations, particularly in infants, where it may significantly affect quality of life and feeding behavior. Alginates have emerged as a non-pharmacological treatment option with a favorable safety profile.

**Aim**

The aim of this review was to evaluate the effectiveness of alginates in the management of gastroesophageal reflux disease in children and to discuss their clinical applicability.

**Material and methods**

A narrative review was conducted based on literature published between 2014 and 2025 identified through PubMed, Scopus, and Google Scholar databases. Emphasis was placed on pediatric studies, randomized controlled trials, systematic reviews, and meta-analyses.

**Results**

Available evidence suggests that alginate-based formulations may reduce symptoms of gastroesophageal reflux in infants and children. Their mechanism of action is based on the formation of a physical barrier that prevents reflux episodes. However, the number of high-quality pediatric studies remains limited, and results are not fully consistent.

**Conclusions**

Alginates represent a safe and potentially effective therapeutic option for selected pediatric patients with GERD. Nevertheless, further well-designed clinical trials are required to confirm their efficacy and define their role in treatment algorithms.

**Key words:** alginates, alginate therapy, gastroesophageal reflux disease, children's population, infants, pediatric gastroenterology, gastroenterology, pediatric population.

## Introduction

Gastroesophageal reflux (GER) in children is quite common and refers to the involuntary backflow of stomach contents into the esophagus. It is usually a physiological phenomenon and is typically managed with conservative measures. In contrast, gastroesophageal reflux disease (GERD) is less common and represents a pathological condition that can lead to symptoms such as intense crying, irritability, regurgitation, vomiting, respiratory manifestations, and feeding difficulties such as low food intake which can lead to growth restrictions. GERD often requires medical treatment. The clinical presentation of GERD in young children is highly variable and often nonspecific, which makes careful diagnostic evaluation essential [1,2].

Combined esophageal pH monitoring with multichannel intraluminal impedance measurement is considered the most accurate diagnostic method for gastroesophageal reflux disease when the diagnosis remains uncertain [11].

The main pathogenic mechanism of GERD in children, as in adults, is abnormal transient lower esophageal sphincter relaxation (TLESR). Other factors implicated in the pathogenesis of GERD include the anatomy and integrity of the antireflux barrier, as well as those affecting esophageal peristalsis and prolonged stomach emptying [1,3,5]. Many factors, such as reduced lower esophageal sphincter tone associated with genetic disorders characterized by reduced muscle tone, contribute to the persistence of GERD and the need for long-term treatment.

Prevalence of GERD: Around half of healthy infants experience regurgitation at least once daily, with the highest frequency observed at about 4 months of age. This typically resolves spontaneously, disappearing in approximately 90% of children by 12 months. In contrast, the incidence of GERD tends to rise with age and reaches levels comparable to adults (around 20%) during adolescence [4].

Management of GERD in children remains challenging. It is recommended to begin with conservative management, including optimizing feeding practices, using age-appropriate feed thickeners, assessing for cow's milk protein allergy, and providing safe positioning advice.

Pharmacological therapies, including proton pump inhibitors (PPIs), should be used for a limited duration (4-8 weeks) with a planned step-down approach due to potential risks such as infections, micronutrient deficiencies and diseases associated with gut microbiota dysbiosis (e.g., SIBO, IMO). Surgical intervention in pediatric patients is typically avoided because of the risk of long-term adverse outcomes and should be reserved for well-documented, treatment-resistant, or complicated cases and considered within a multidisciplinary framework [4,6,7].

Therefore, there is increasing interest in alternative and safer therapeutic options that may be suitable for longer-term use. Alginates have gained attention as a non-systemic treatment for GERD. Derived from brown seaweed, alginates act through a mechanical mechanism by forming a gel-like barrier that prevents reflux of gastric contents. This property makes them particularly attractive for use in pediatric populations [8].

**Research Objective.** To evaluate the effectiveness and safety of alginate-based therapies in children with GERD.

**Research Problems.** What is the clinical efficacy of alginates in pediatric GERD, and what are their limitations?

**Research Hypotheses.** Alginates may reduce symptoms of GERD in children; however, their effectiveness may be limited by the availability of high-quality evidence. Nevertheless, they can be an alternative if long-term treatment is necessary.

## Research materials and methods

A narrative review methodology was applied in this study. The literature search was conducted using major scientific databases, including PubMed, Scopus, Web of Science, and Google Scholar. The search strategy included combinations of the following keywords: "alginates," "alginate therapy," "gastroesophageal reflux disease," "GERD," "children," "infants," and "pediatric population."

The review focused primarily on studies published between 2014 and 2025 in order to ensure the inclusion of up-to-date and clinically relevant evidence. Preference was given to high-quality publications, including randomized controlled trials, systematic reviews, meta-analyses, and clinical guidelines.

The primary focus of the analysis was on the pediatric population, including infants, children, and adolescents diagnosed with gastroesophageal reflux disease. However, due to the limited number of high-quality studies conducted exclusively in children, selected studies involving adult populations were also included when they provided important insights into the mechanism of action, efficacy, or safety of alginate-based therapies.

Inclusion criteria comprised:

- studies evaluating the use of alginate-based formulations in the management of gastroesophageal reflux disease,
- publications involving pediatric patients or providing relevant translational data from adult populations,
- articles available in full-text and published in English.

Exclusion criteria included:

- studies published before 2014 (unless considered essential for understanding fundamental mechanisms),
- case reports with limited clinical applicability,
- non-peer-reviewed publications.

The selection of articles was based on relevance to the topic, methodological quality, and clinical applicability. Additional sources were identified through manual screening of reference lists of selected publications.

No formal statistical analysis was performed, as this study represents a narrative review. This approach may introduce selection bias due to the narrative nature of the review.

**Mechanism of action of alginates**

Alginate is a polysaccharide obtained from brown seaweed. Preparations containing alginates help reduce gastroesophageal reflux through both chemical and mechanical actions. Sodium alginate and magnesium alginate are used as different salt forms of alginic acid.

Unlike conventional antacids, alginate-based formulations work via a distinct mechanism. When they come into contact with gastric acid, they precipitate and form a gel. If bicarbonate is included in the formulation, it reacts to produce carbon dioxide, which becomes trapped within this gel. As a result, a foamy "raft" is created that floats on top of the stomach contents, acting as a physical barrier to reflux [8,9].

The effectiveness and stability of this alginate raft depend on several factors, such as the presence of calcium or aluminum and the amount of generated carbon dioxide. For safety reasons, aluminum-free formulations are preferred. Additionally, attention should be paid to the sodium content, especially during long-term use, in particular in preterm infants and in children with renal impairment [8,9].

Several mechanisms contribute to their effectiveness:

- formation of a protective barrier,
- reduction of reflux episodes,
- partial neutralization of gastric acid (depending on formulation).

Importantly, alginates do not significantly alter gastric pH, distinguishing them from PPIs and H2-receptor antagonists. This characteristic may contribute to their favorable safety profile.

**Clinical evidence in pediatric populations**

The clinical effectiveness of alginates in children has been evaluated in several studies; however, the overall number of high-quality randomized controlled trials remains limited. The available evidence in pediatric populations remains limited compared to adults. Despite this limitation, available data suggests that alginate-based formulations may provide symptomatic relief in pediatric patients with gastroesophageal reflux disease (GERD).

One of the most important studies in the pediatric population is the prospective trial by Salvatore et al. [8], which demonstrated that alginate administration significantly reduced both acid and non-acid reflux episodes, as measured by combined pH-impedance monitoring. In addition to objective improvements, clinically relevant reductions in symptoms such as regurgitation, crying, and irritability in infants were observed. These findings are particularly important, as non-acid reflux is common in infants and often not adequately addressed by acid-suppressive therapy.

Similarly, a systematic review by Ablaza et al. [12] confirmed that alginate-based formulations may reduce the frequency and severity of reflux episodes in neonates and infants. Similar findings were reported in other studies [15,16]. However, the authors emphasized that the available studies are heterogeneous in terms of design, population, and outcome measures, which limits the strength of conclusions.

Evidence from adult populations further supports the effectiveness of alginates. A randomized, placebo-controlled trial by Thomas et al. [10] demonstrated that alginate-antacid formulations targeting the postprandial

acid pocket significantly improved upper gastrointestinal symptoms compared with placebo. These findings are relevant for pediatric practice, as the mechanism of reflux, including the role of the acid pocket, is similar across age groups.

Meta-analyses conducted in broader populations indicate that alginate therapy is more effective than placebo in reducing GERD symptoms, including heartburn and regurgitation, while maintaining a favorable safety profile [13].

Importantly, current clinical guidelines for pediatric GERD highlight the role of non-pharmacological and stepwise management approaches [14]. Alginates are often considered a therapeutic option in infants and children with mild to moderate symptoms, particularly when there is a need to avoid or delay acid-suppressive therapy. Recent reviews also emphasize their favorable safety profile and potential utility as first-line or adjunctive treatment in selected patients, particularly in patients who require long-term therapy [1,6,15].

Table 1. Summary of studies evaluating alginate therapy in gastroesophageal reflux disease.

| Author (year) | Study design | Population | Intervention | Outcomes | Main findings |
|---|---|---|---|---|---|
| **Salvatore et al. (2018) [8]** | Prospective study | Infants with GERD | Alginate | pH-impedance, symptoms | Significant reduction in acid and non-acid reflux episodes; improvement in regurgitation and crying |
| **Ablaza et al. (2024) [12]** | Systematic review | Neonates and infants | Alginate formulations | Symptom frequency, safety | Reduction in reflux episodes; evidence limited and heterogeneous |
| **Thomas et al. (2014) [10]** | RCT, placebo-controlled | Adults with GERD | Alginate-antacid | Symptom relief | Significant improvement vs placebo; rapid onset of action |
| **Leiman et al. (2017) [13]** | Meta-analysis | GERD patients | Alginate therapy | Symptom reduction | More effective than placebo; not superior to PPIs |
| **Baldassarre et al. (2019) [15]** | Multicenter crossover study | Infants | Magnesium alginate | GER symptoms (I-GERQ-R) | Significant reduction in reflux symptoms; comparable efficacy to thickened formula |

**Comparison with other treatment options**

Management of GERD in children includes:

- lifestyle and feeding modifications,
- pharmacological therapy (PPIs, H2 blockers),
- thickened feeds,
- prokinetic agents.

Proton pump inhibitors act by irreversibly inhibiting the $H^+/K^+$-ATPase in gastric parietal cells, leading to profound suppression of gastric acid secretion. While this mechanism is effective in reducing acid-related symptoms, long-term acid suppression disrupts the physiological barrier function of gastric acid.

Gastric acid plays a crucial role in limiting bacterial colonization of the gastrointestinal tract. When gastric pH is increased due to prolonged PPI therapy, survival and proliferation of ingested and oral bacteria are facilitated, leading to alterations in the gut microbiota composition [19].

These changes include:

- decreased microbial diversity,

- increased colonization by oral and potentially pathogenic bacteria,
- higher risk of infections,
- impaired absorption of vitamins (e.g., B12, iron, magnesium),
- alterations in immune and metabolic processes.

Additionally, reduced gastric acidity promotes small intestinal bacterial overgrowth (SIBO, IMO) due to impaired bacterial clearance.

Adverse effects of PPIs include headaches, diarrhea, nausea, and constipation [18,20].

Acid suppression (PPIs) may place immune-deficient infants and children, or those with indwelling catheters, at risk for the development of lower respiratory tract infections and nosocomial sepsis.

Prokinetic agents have many adverse effects, without major benefits to support their routine use [18]. Their use should be reserved for patients with documented delayed gastric emptying.

Compared to proton pump inhibitors (PPIs) or H2-receptor antagonists (H2RAs), alginates:
- have a faster onset of action,
- appear less effective,
- do not affect acid production systemically,
- have fewer reported adverse effects,
- can be used for a prolonged period of time,
- have minimal impact on microbiota.

However, PPIs remains more effective in healing esophagitis.

Compared to thickened feeds, alginates provide a more targeted mechanism of action, although both approaches may reduce regurgitation.

Current guidelines recommend a stepwise approach, with non-pharmacological strategies as first-line treatment [13,14,17].

Table 2. Comparison of therapeutic options in the management of gastroesophageal reflux disease in children

| **Parameter** | **Alginates** | **Proton Pump Inhibitors** | **Thickened feeds** |
|---|---|---|---|
| **Mechanism of action** | Formation of a physical "raft" barrier preventing reflux | Inhibition of gastric acid secretion (H+/K+ ATPase) | Increased viscosity of feeds reducing regurgitation |
| **Effect on acid reflux** | Moderate reduction (mechanical) | Strong reduction (acid suppression) | Minimal direct effect |
| **Effect on non-acid reflux** | Yes (reduces both acid and non-acid reflux) | No significant effect | Limited effect |
| **Symptom relief** | Effective in mild to moderate GERD | Highly effective, especially in esophagitis | Effective for regurgitation |
| **Onset of action** | Rapid (postprandial effect) | Delayed (several days) | Immediate |
| **Efficacy in infants** | Moderate (supported by limited studies) | Limited (often not recommended routinely) | Good for regurgitation |
| **Efficacy in older children** | Moderate | High | Limited |
| **Safety profile** | Favorable (non-systemic mechanism) | Potential adverse effects (infections, microbiota changes) | Generally safe |
| **Long-term use** | Limited data, but considered safe | Potential risks with long-term use | Safe |
| **Impact on microbiota** | Minimal | Significant alterations possible | Minimal |

| Parameter | Alginates | Proton Pump Inhibitors | Thickened feeds |
|---|---|---|---|
| **Guideline recommendation** | Considered as first-line or adjunct in mild cases | Reserved for confirmed GERD with complications | First-line in infants with regurgitation |
| **Clinical role** | Symptomatic treatment, especially in infants | Treatment of confirmed GERD and esophagitis | Initial management of uncomplicated reflux |

**Limitations and safety considerations**

Nevertheless, several limitations must be acknowledged. The number of well-designed randomized controlled trials in pediatric populations remains limited, and long-term safety data are scarce. Additionally, variability in alginate formulations and dosing regimens may influence treatment outcomes.

Despite their promising profile, alginates have several limitations:

- limited number of pediatric RCTs,
- heterogeneity of study designs,
- short duration of follow-up.

Safety concerns are generally minimal. Alginates are well tolerated, with few reported side effects. However, long-term safety data in children are still insufficient.

Additionally, some formulations contain sodium, which may be relevant in specific patient populations, for example, patients with impaired renal function.

**Practical considerations**

In clinical practice, alginates may be considered:

- in infants with symptomatic reflux as a first line of treatment,
- in patients with mild to moderate GERD,
- as an alternative or adjunct to pharmacological therapy,
- as a maintenance therapy following proton pump inhibitor treatment,
- in patients with immune deficiency,
- in case of intolerance to proton pump inhibitors.

Key practical points:

- dosing should be age-appropriate,
- therapy should be supervised by a physician,
- response should be regularly evaluated.

Parental education is essential to ensure proper use and adherence.

**Discussion**

This review highlights that alginates represent a promising therapeutic option for pediatric GERD. Their unique mechanism of action and favorable safety profile make them particularly attractive in infants and pediatric populations, where long-term safety is a key consideration.

However, the current evidence base remains limited. While some studies demonstrate clinical benefits, others show inconsistent results. This discrepancy may be due to differences in study populations, formulations, and outcome measures.

Importantly, the role of alginates should be considered within a broader treatment strategy that includes dietary and behavioral interventions as a non-pharmacological strategy.

From a clinical perspective, alginates appear to be a valuable therapeutic option in children with mild to moderate GERD, particularly when a favorable safety profile is required, whereas proton pump inhibitors remain more appropriate in cases of documented esophagitis or severe disease requiring effective acid suppression.

Future research should focus on:

- large randomized controlled trials,
- long-term safety,
- determining the dosage and specific indications,
- standardized outcome measures.

## Conclusions

Overall, current evidence suggests that alginates may be effective in reducing reflux-related symptoms in children, particularly in infants. However, further high-quality studies are required to better define their efficacy, optimal dosing, and role in pediatric GERD management.

Alginates are a safe option for the management of gastroesophageal reflux disease in children, particularly in mild to moderate cases.

Their use should be individualized and integrated into a comprehensive treatment plan.

Alginates may not be superior to proton pump inhibitors (PPIs), which remain the most effective treatment for acid suppression [13].

Further high-quality randomized controlled trials in pediatric populations are essential to establish clear clinical recommendations.

## Disclosures

Author's contribution:

Conceptualization: AJ, WK, JJ

Methodology: AJ, MW, MA

Software: AJ, WK

Validation: KG, KO

Formal analysis: AJ, WK, KO

Investigation: MG, KG, JK

Resources: WP, MG

Data curation: WP, MW

Writing – original draft: AJ, MA, KO

Writing – review & editing: JJ, MG

Visualization: AJ, WK, JJ

Supervision: AJ

Project administration: AJ

All authors have read and approved the published version of the manuscript.

Funding: The study did not receive external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Acknowledgements: Not applicable.

Conflicts of Interest: The authors declare no conflicts of interest.

**Declaration of the use of generative AI and AI-assisted technologies in the writing process:**

During the preparation of this manuscript, the authors utilized AI tools for language correction and stylistic refinement in order to enhance clarity and readability. Following the use of these tools, the authors carefully reviewed and revised the content as necessary and assume full responsibility for the accuracy, integrity, and conclusions presented in the publication.

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