Herbal Medicines for Gastrointestinal Disorders in Children and Adolescents: A Systematic Review

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abstract

CONTEXT: Gastrointestinal disorders are common childhood complaints. Particular types of complementary and alternative medicine, such as herbal medicine, are commonly used among children. Research information on efficacy, safety, or dosage forms is still lacking.

OBJECTIVES: To systematically summarize effectiveness and safety of different herbal treatment options for gastrointestinal disorders in children.

DATA SOURCES: Medline/PubMed, Scopus, and the Cochrane Library were searched through July 15, 2016.

STUDY SELECTION: Randomized controlled trials comparing herbal therapy with no treatment, placebo, or any pharmaceutical medication in children and adolescents (aged 0–18 years) with gastrointestinal disorders were eligible.

DATA EXTRACTION: Two authors extracted data on study design, patients, interventions, control interventions, results, adverse events, and risk of bias.

RESULTS: Fourteen trials with 1927 participants suffering from different acute and functional gastrointestinal disorders were included in this review. Promising evidence for effectiveness was found for *Potentilla erecta*, carob bean juice, and an herbal compound preparation including *Matricaria chamomilla* in treating diarrhea. Moreover, evidence was found for peppermint oil in decreasing duration, frequency, and severity of pain in children suffering from undifferentiated functional abdominal pain. Furthermore, evidence for effectiveness was found for different fennel preparations (eg, oil, tea, herbal compound) in treating children with infantile colic. No serious adverse events were reported.

LIMITATIONS: Few studies on specific indications, single herbs, or herbal preparations could be identified.

CONCLUSIONS: Because of the limited number of studies, results have to be interpreted carefully. To underpin evidence outlined in this review, more rigorous clinical trials are needed.

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Mr Anheyer conceptualized and designed the study, conducted the literature review, collected the data, created the tables and figures, and drafted the initial manuscript; Drs Cramer and Lauche participated in conceptualizing and designing the review, participated in collecting the data, and reviewed and revised the manuscript; Dr Frawley and Ms Koch participated in drafting the initial manuscript, and reviewed and revised the manuscript; Drs Dobos and Langhorst critically reviewed the manuscript; and all authors approved the final manuscript as submitted.

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Functional gastrointestinal disorders like irritable bowel syndrome (IBS), functional abdominal pain, constipation, and infantile colic as well as acute gastrointestinal disorders like gastroenteritis are common childhood complaints that affect a large proportion of children and adolescents.[1–4] Beside the painful impacts for the child, gastrointestinal disorders can lead to lower quality of life, school absenteeism, and a higher risk of depression and anxiety.[5,6] Parents are also affected not only because they commiserate with their offspring but also because of the time needed to care for their child. Therefore, gastrointestinal disorders in children and adolescents may lead to both major reductions in quality of life for the child and parents and major socioeconomic impacts for the family and wider society.[5–7]

The management of gastrointestinal disorders in children and adolescents, especially functional gastrointestinal disorders, can be challenging.[8,9] Parents often visit different practitioners in search of a reliable diagnosis or therapy. Many available treatments are either effective but yield potential for undesirable adverse effects, or safe but might lack effectiveness.[10] This may lead to conflicting advice, different prescribed treatments, and high direct and indirect costs.[7,11,12] In this context, a high prevalence of complementary and alternative medicine (CAM) use can be observed among patients suffering from gastrointestinal disorders.[13–16] Research suggests that parents often favor CAM products, such as herbal medicine, in the belief they are natural and therefore safe.[17] In addition to this, evidence suggests some parents may also be dissatisfied or fear the side effects of conventional medication.[18] As a result, parents often do not disclose the use of CAM to the attending pediatrician.[19–23]

Whereas ~52% of all children in Europe are using some kind of CAM, the use of particular types of CAM, such as herbal medicine, is increasingly common among children.[20,24–27] Although herbal medicines are commonly used, research detailing information on efficacy, safety, dosage forms, and dose quantities is still lacking. In response, the scope of this review is to systematically summarize the effectiveness and safety of different herbal treatment options for gastrointestinal disorders in children and adolescents.

METHODS

This review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines and recommendations of the Cochrane Collaboration.[28,29]

Eligibility Criteria

Types of Studies

Randomized controlled trials (RCTs), randomized cross-over trials, and cluster-randomized trials were eligible. Trials were included if they were published in English or German.

Types of Participants

Only studies on children (0–12 years of age) or adolescents (13–18 years of age) were included if patients suffered from gastrointestinal complaints such as diarrhea, constipation, colic, IBS, inflammatory bowel diseases, and other disorders of the gastrointestinal tract.

Types of Interventions

Studies that compared herbal medicines with treatment-as-usual or other active comparators, placebo, or no treatment were eligible. If the herbal drug was applied only in homeopathic potency or if the herb is exclusively used in traditional Chinese medicine (so-called Chinese herbal medicine often includes ingredients of animal or mineral origin), the study was not included in this review. No other dosage restrictions were made.

Search Methods

Medline/PubMed, Scopus, and the Cochrane Central Register of Controlled Trials (Central) were searched from their inception dates to July 15, 2016. Embase was not searched separately because it is included in Scopus. Because this article is part of a major project to identify evidence for herbal therapy in children, the literature search was widely constructed around basic search terms for "children" and search terms for "herbal therapy." The complete search strategy for PubMed/Medline is shown in Supplemental Information. For each database, the search strategy was adapted as necessary. Abstracts identified during the literature search were screened, and potentially eligible articles were read in full independently by 3 review authors (DA, HC, and RL) to determine if they met eligibility criteria. After identifying the literature in the field of interest, only these articles with children and adolescents suffering from gastrointestinal complaints as mentioned above were taken into account.

Data Extraction and Management

Extraction of data on methods, patients (eg, age, sex, diagnosis), interventions (herbs, dose, etc), control interventions, and results was performed by 2 review authors (DA and RL) independently by using an a priori-developed data extraction form. Discrepancies were rechecked with a third reviewer (HC) and discussed until consensus was achieved.

Risk of Bias in Individual Studies

By using the Cochrane risk of bias tool, the risk of bias of each included study was assessed by 2 authors

(DA and HC) independently. This tool assesses risk of bias by using 7 criteria (rating: low, unclear, or high risk of bias): random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other biases. Discrepancies were rechecked with a third reviewer and discussed until consensus was achieved. Trial authors were contacted for further details if necessary.

RESULTS

Literature Search

Literature search retrieved 10 083 nonduplicate records, of which 259 full texts were assessed for eligibility. Eighty-six of them were considered to be eligible for the whole field of herbal medicine in children and adolescents, whereas 173 full texts were excluded for the following reasons: they were not RCTs, the investigated herbs were exclusively used in traditional Chinese medicine, the herbal drug was applied only in homeopathic potency, or the study had no participants between 0 and 18 years exclusively. Finally, 14 full-text articles involving a total of 1927 participants suffering from gastrointestinal disorders were included in this review (Fig 1).

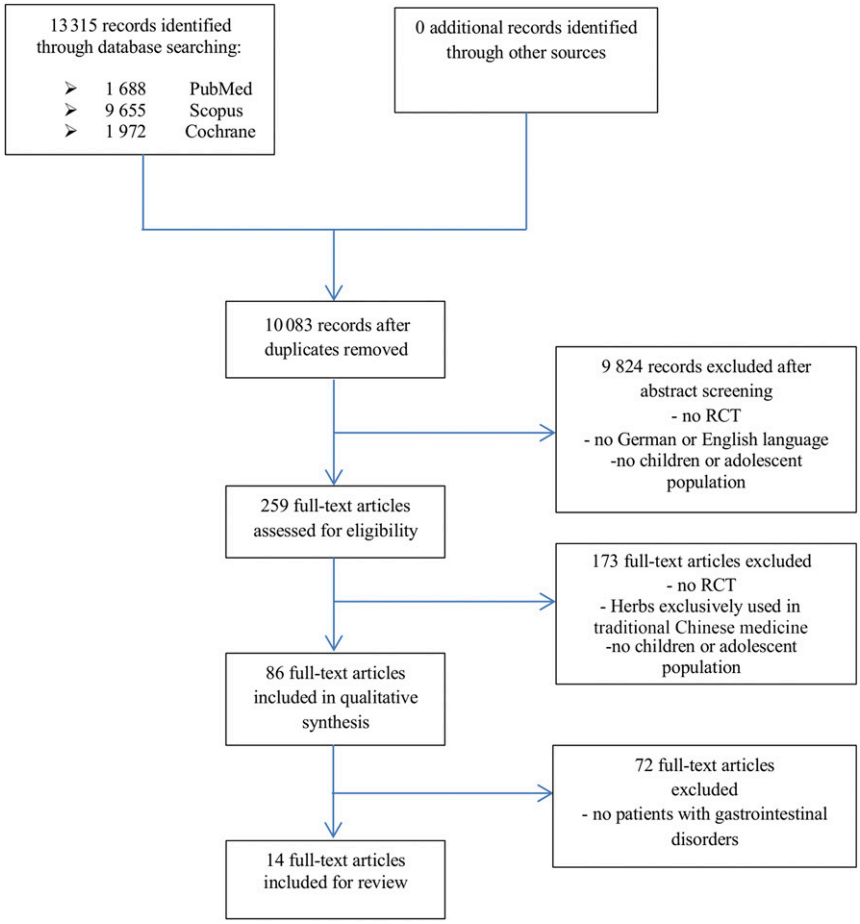

FIGURE 1
Flowchart of the results of the literature search.

Study Characteristics and Intervention Characteristics

Detailed characteristics of samples sizes, interventions, outcome assessments, and results are shown in Table 1.

Risk of Bias in Individual Studies

The risk of biased judgment in individual studies is shown in Figs 2 and 3. Researchers for 8 studies had reported adequate random sequence generation, whereas for 6 RCTs the randomization procedure remained unclear. Researchers for only 5 of the included studies reported adequate allocation concealment. Researchers for 3 of the included trials did not report blinding of patients and personnel, and 2 studies did not reveal adequate blinding of outcome assessment. Three of the 14 trials had high risk of attrition bias, and 2 were not free of suspected selective reporting. Because of multiple primary outcomes without performing an α-correction, a high risk of other bias has to be suspected for 2 RCTs.

Gastroenteritis

Diarrhea

Researchers in 4 studies with a total of 424 participants researched the efficacy of herbal medicine for the treatment of acute diarrhea in children. Two studies observed an herbal compound preparation (Diarrhoesan) containing apple pectin and *M chamomilla*.[32,33] Both studies demonstrated a significant reduction in the duration of diarrhea compared with placebo. Additionally, Becker et al[32] showed that the herbal compound significantly reduced stool frequency in comparison with placebo.

Subbotina et al[31] investigated the effectiveness of *P erecta* in treating children with diarrhea due to a rotavirus infection. The duration of diarrhea, abnormal stool, and hospitalization, as well as stool output was decreased significantly compared with placebo.

Researchers in another study observed carob bean juice as an add-on therapy compared with standard therapy alone.[30] The duration of diarrhea, stool output,

TABLE 1 Characteristics of Included Studies

Author	Study population	Experimental group age, median	Control group age, median	Intervention(s)	Control condition(s)	Measurement(s)	Outcome measure(s)	Results
Gastroenteritis Diarrhea								
Akşit et al[30]	Patients with acute diarrhea, *N* = 80; age: 4–48 mo	15 ± 13 mo	18 ± 14 mo	WHO-ORS and CBJ 20 mL/kg body weight and breast milk or cows' milk-yoghurt-mix	WHO-ORS 20 mL/kg body weight and breast milk or cows' milk-yoghurt-mix	Initial visit, then regularly until diarrhea stopped	Primary outcome 1. Duration of diarrhea (d) 2. Stool output (g/kg body weight) Secondary outcomes 1. WHO-ORS intake (mL/kg body weight) 2. Weight gain in percent 3. Serum sodium (mmol/L) 4. Serum potassium (mmol/L)	Significant group differences after therapy Primary outcome 1. Duration of diarrhea (d) 2. Stool output (g/kg body weight) Secondary outcomes 1. WHO-ORS intake (mL/kg body weight) 2. Serum sodium (mmol/L) 3. Serum potassium (mmol/L
Subbotina et al[31]	Patients with rotavirus diarrhea, *N* = 40; age: 3 mo–7 y	23.5 mo	22.5 mo	WHO-ORS 20 mL/kg body weight; 3 drops *P erecta* elixir (1 part of dried root with 10 parts of 40% ethyl alcohol) per year of life, 3 times daily until discontinuation of diarrhea or maximum of 5 d	WHO-ORS 20 mL/kg body weight; 3 drops placebo elixir per year of life, 3 times daily until discontinuation of diarrhea or maximum of 5 d	Initial visit, then daily until diarrhea ceased, or stool output was <10 mL/kg/d, stool consistency was normalized, and symptoms of dehydration were corrected	Primary outcome 1. Duration of diarrhea (d) Secondary outcomes 1. Duration of abnormal stool (d) 2. Duration of hospitalization (d) 3. Stool output (mL/kg/d) 4. Oral rehydration volume (mL/kg/d)	Significant group differences after therapy Primary outcome 1. Duration of diarrhea (d) Secondary outcomes 1. Duration of abnormal stool (d) 2. Duration of hospitalization (d) 3. Stool output (mL/kg/d)
Becker et al[32]	Patients with acute diarrhea, *N* = 225; age: 6 mo–6 y	33.76 ± 22.99 mo	33.02 ± 22.77 mo	Oralpädon and Diarrhoesan (apple pectin, *M chamomilla*) dosage: Diarrhoesan up to 40–80 mL/d depending on age; Oralpädon within the first 24 h: 1 sachet after each stool over 5 d	Oralpädon and placebo in same dosage	Initial visit, and at day 3 and day 5 of intervention	Primary outcome 1. Duration of diarrhea (h) 2. Stool frequency 3. Consistency of stool Secondary outcomes 1. Therapeutic response 2. General condition 3. Existence of abdominal cramps 4. Efficacy	Significant group differences after therapy Primary outcome 1. Duration of diarrhea (h) 2. Stool frequency

TABLE 1 Continued

Author	Study population	Experimental group age, median	Control group age, median	Intervention(s)	Control condition(s)	Measurement(s)	Outcome measure(s)	Results
De la Motte et al[33]	Patients with acute diarrhea, *N* = 79; age: 6 mo–5.5 y	—	—	Diarrhoesan 5 mL per dose bag, maximum dose 12 bags a day depending on age	Placebo in same dosage	Diary assessed by parents: Initial, then 2 times/d until diarrhea ceased	Primary outcome 1. Duration of diarrhea (h) Secondary outcomes 1. Consistency of stool 2. Well-being	Significant group differences after therapy Primary outcome 1. Duration of diarrhea (h)
Dehydration								
Freedman et al[34]	Patients with mild gastroenteritis, *N* = 647; age: 6–60 mo	28 ± 15.4 mo	29 ± 16.5 mo	Half-strength apple juice, 5 mL aliquots every 2–5 min up to 2 L, and preferred other liquids (juices or milk)	Apple-flavored, sucralose-sweetened pediatric electrolyte solution, in same dosage	Initial visit, then daily telephone assessment by parents for 7 d of intervention	Primary outcome 1. Treatment failure, defined as a composite score of intravenous rehydration or hospitalization, subsequent unscheduled physician encounter, protracted symptoms or significant weight loss occurring within 7 d of enrollment Secondary outcomes 1. Intravenous rehydration 2.Hospitalization 3. Frequency of diarrhea and vomiting 4. Percentage of weight change	Significant group differences after therapy Primary outcome 1. Treatment failure Secondary outcomes 1. Intravenous rehydration

TABLE 1 Continued

Author	Study population	Experimental group age, median	Control group age, median	Intervention(s)	Control condition(s)	Measurement(s)	Outcome measure(s)	Results
Functional gastrointestinal disorders								
Infantile colic								
Alexandrovich et al[35]	Patients with infantile colic, *N* = 125; age: 2–12 wk	29.7 ± 8.2 d	30.5 ± 6.9 d	Emulsion of 0.1% of fennel seed oil (*F vulgare*) and 0.4% polysorbate-80 in water, a minimum of 5 mL and a max of 20 mL up to 4 times a day	Emulsion of 0.4% polysorbate-80 in water in same dosage	Diary assessed by parents. Diaries were entered for 21 d (7 d before the trial, during the 7-d trial, 7 d after the trial). Visits before, during, and after intervention	Primary outcome 1. Relief of colic symptoms (defined as <9 h cumulative crying h/wk) Secondary outcomes 1. Cumulative crying at the end of treatment (h/wk) 2. Consumed emulsion/ placebo (mL/d) 3. No. doses per day	Significant group differences after therapy Primary outcome 1. Relief of colic symptoms (defined as <9 h cumulative crying h/wk) Secondary outcomes 1. Cumulative crying at the end of treatment (h/wk) 2. Consumed emulsion/ placebo (mL/d) 3. No. doses/d
Alves et al[36]	Patients with infantile colic, *N* = 30; age: 8–56 d (m = 33 ± 11.1 d)	—	—	Peppermint oil drops (1 drop/kg body weight).	Simethicone drops (2.5 mg/kg body weight)	Initial visit, and at day 7 and day 17 of intervention	Primary outcome 1. Responses to treatment 2. Daily episodes of colic 3. Crying time (h) Secondary outcomes 1. Milk regurgitation 2. Vomiting 3. Diarrhea 4. Constipation 5. Drowsiness	Significant group differences after therapy No significant group differences for responses to treatment. No other results reported

TABLE 1 Continued

Author	Study population	Experimental group age, median	Control group age, median	Intervention(s)	Control condition(s)	Measurement(s)	Outcome measure(s)	Results
Arikan et al[37]	Patients with infantile colic, *N* = 175; age: 4–12 wk	2.24 ± 0.69 mo	contr grp 1: 2.29 ± 0.75 mo contr grp 2: 1.97 ± 0.75 mo contr grp 3: 1.97 ± 0.71 mo contr grp 4: m = 2.28 ± 0.61 mo	Fennel tea (*F vulgare*) 3 times a day 35 mL up to 150 mL	Grp. 1: massage 2 times 25 min/d; grp. 2: 12% sucrose solution 2 times a day 2 mL; grp. 3: hydrolyzed formula; grp. 4: treatment as usual	Diary assessed by parents, 7 d during the intervention	Primary outcome 1. Crying time (h) Secondary outcomes No secondary outcomes	Significant group differences after therapy Primary outcome 1. Crying time (h) when compared with treatment as usual. No comparison of fennel tea to the other interventions was performed
Savino et al[38]	Patients with infantile colic, *N* = 93; age: 21–60 d	4.2 ± 1.4 wk	4.4 ± 1.6 wk	ColiMil (*F vulgare*, *M chamomilla*, *M officinalis*) 2 mL/kg (body weight)	Placebo in same dosage	Initial visit, and after intervention period (7 d). Diary assessed by parents, 7 d during the intervention and 14 d after intervention	Primary outcome 1. Crying time (mean min/d) Secondary outcomes 1. Treatment responding	Significant group differences after therapy Primary outcome 1. Crying time (mean min/d) Secondary outcomes 1. Treatment responding
Weizmann et al[39]	Patients with infantile colic, *N* = 68; age: 2–8 wk	21.1 ± 9.3 d	24.6 ± 7.6 d	Herbal tea preparation (*M chamomilla*, *V officinalis*, *G glabra*, *F vulgare*, *M officinalis*); every episode of colic, up to 150 mL/dose, not more than 3 times a day	Placebo tea preparation: instant powder of glucose and natural flavors in same dose	Diaries assessed by parents: 7 d with no therapy, and 7 d of treatment. Initial examination by pediatrician, and at day 7, and day 14	1. No. of night wakings requiring parental response 2. Elimination of colic 3. Colic improvement No primary outcome defined	Significant group differences after therapy 1. Elimination of colic 2. Colic improvement
Irritable bowel syndrome								
Kline et al[40]	Patients with irritable bowel syndrome, *N* = 42; age: (8–17 y) Total: m = 12 y	—	—	Colpermin capsules (pH-dependent peppermint oil 187 mg), 3 times/d 1–2 capsules depending on weight	Placebo capsules with peanut oil in same dosage	Initial visit, and at day 14 of intervention	Primary outcome 1. Gastrointestinal symptom rating	Significant group differences after therapy No significant group differences

TABLE 1 Continued

Author	Study population	Experimental group age, median	Control group age, median	Intervention(s)	Control condition(s)	Measurement(s)	Outcome measure(s)	Results
Shulman et al[41]	Patients with irritable bowel syndrome *N* = 103; age: 7–18 y	13.1 ± 0.4 y	13.5 ± 0.4 y	Psyllium fiber powder, 6–12 g depending on age per day	Maltodextrin powder in same dosage	2 wk baseline measurement, 6 wk treatment period, final assessment within the last 2 wk of treatment period	Primary outcome 1. Number abdominal pain episodes 2. Severity of abdominal pain episodes 3. Percentage of normal stools Secondary outcomes 1. Changes in breath hydrogen/methane production 2. Gut permeability	Significant group differences after therapy Primary outcome 1. Number abdominal pain episodes
Functional abdominal pain								
Asgarshirazi et al[42]	Patients with functional abdominal pain, *N* = 120; age: 4–13 y	7.06 ± 2.38 y	contr grp 1: 7.42 ± 2.49 y contr grp 2: 7.44 ± 2.44 y	Colpermin capsules (pH-dependent peppermint oil 187 mg), 3 times/d 1–2 capsules depending on weight	Grp 1: Folic acid tablet 1 mg, daily 30 min before breakfast or lunch; grp 2: Lactol tablets (150 million spores of *Bacillus* coagulans + Fructooligosaccharide), 3 times/d after meals	Questionnaire before, and after 4 wk intervention. Periodic visits during intervention period	1. Duration of pain (min/d) 2. Frequency of pain, per week 3. Severity of pain No primary outcome defined	Significant group differences after therapy Compared with Placebo 1. Duration of pain (min/d) 2. Frequency of pain, per week 3. Severity of pain Compared with Lactol 1. Duration of pain (min/d) 2. Severity of pain
Constipation								
Quitadamo et al[43]	Patients with chronic functional constipation, *N* = 100; age: 4–10 y	6.5 ± 2.6 y	6.7 ± 2.8 y	Mixture of Acacia fiber, Psyllium, and fructose powder 16.8 g/d + 0.5 g/kg body weight	Polyethylene glycol 3350 with electrolytes 16.8 g/d + 0.5 g/kg body weight	Initial visit, daily stool diary assessed by parents, and follow-up-visits 1, 2, 4 and 8 wk after enrollment	Primary outcome 1. Improvement of constipation Secondary outcomes 1. Improvement of other associated gastrointestinal symptoms	Significant group differences after therapy No significant differences between both groups

Cbj, carob bean juice; contr: control; grp, group; m, median; max, maximum; WHO-ORS, World Health Organization-oral rehydration solution; —, not applicable.

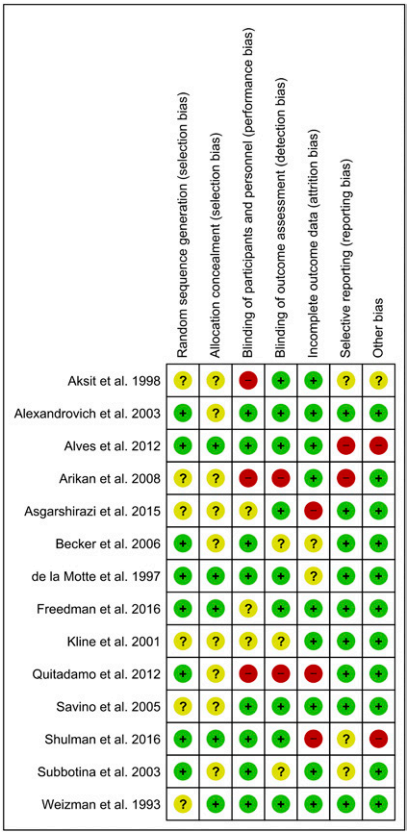

FIGURE 2
Risk of bias assessment: using the Cochrane risk of bias tool and generated with Review Manager 5 software (version 5.2; The Nordic Cochrane Centre, Copenhagen, Denmark).

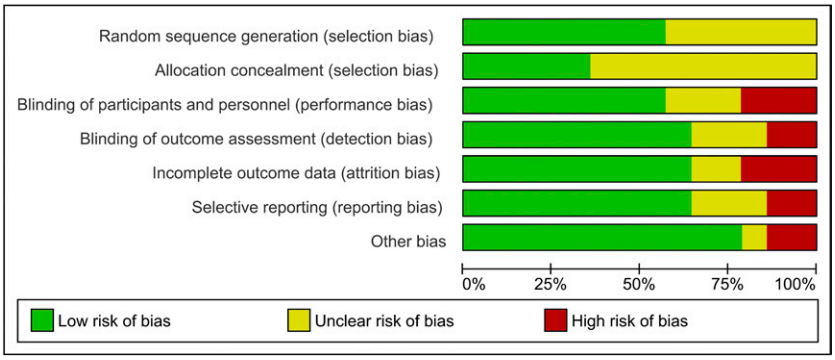

FIGURE 3
Risk of bias graph: presented as percentages across all included studies and generated with Review Manager 5 software (version 5.2; The Nordic Cochrane Centre, Copenhagen, Denmark).

and the intake of a standard rehydration solution was decreased significantly if carob bean juice was given additionally.

Researchers for only 2 of the 4 studies reported adverse events,[32,33] with a total of 12 adverse events being registered. None of these were regarded as related to the trial medication.

Dehydration due to Gastroenteritis

Freedman et al[34] investigated the effectiveness of half-strength apple juice as a rehydration strategy in 647 children with mild gastroenteritis. The results revealed that apple juice intake provoked significantly fewer treatment failures, defined as a composite score of intravenous rehydration or hospitalization, subsequent unscheduled physician encounter, and protracted symptoms or significant weight loss occurring within 7 days of enrollment when compared with a standard rehydration solution.

Freedman et al[34] reported that 2 children were hyponatremic at the time of intravenous insertion (1 in the apple juice group and 1 in the usual care group). No other serious adverse events were reported.

Functional Gastrointestinal Disorders

Infantile Colic

Researchers in 5 studies with a total of 491 participants investigated the efficacy of herbal medicine in infants suffering from colic. One study[37] demonstrated that a tea of *Foeniculum vulgare* could significantly decrease the crying time (hours) when compared with usual care, whereas an herbal tea preparation containing *M chamomilla*, *Verbena officinalis*, *Glycyrrhiza glabra*, *F vulgare*, and *Melissa officinalis* was superior in elimination of colic and colic improvement in comparison with a placebo tea preparation.[39] Similar results were shown by Alexandrovich et al[35] for an emulsion of 0.1% of fennel (*F vulgare*) seed oil. After a 7-day trial, a significant improvement in colic symptoms and cumulative crying time could be observed when compared with placebo. Also, an herbal compound preparation (ColiMil) containing *F vulgare*, *M chamomilla*, and *M officinalis* could reduce the crying time significantly compared with placebo.[38] However, no significant group differences for treatment response, daily episodes of colic, and crying time could be shown for peppermint oil drops in comparison with usual care (Simethicone drops).[36]

Researchers for 4 of the 5 studies reported that no side effects or adverse events were observed during the study period,[35–37,39] whereas Savino et al[38] reported side effects such as vomiting, sleepiness, and constipation. None of these side effects were severe, and there was no significant difference between the herbal compound preparation and placebo in the occurrence of side effects.

Irritable Bowel Syndrome

Two RCTs with a total of 145 participants were conducted to research herbal medicine for the treatment of IBS in children and adolescents. Although capsules of peppermint oil (Colpermin) did not show any significant differences when compared with the placebo,[40] psyllium fiber powder[41] significantly reduced the number of abdominal pain episodes in comparison with the placebo (maltodextrin powder).

The authors of both trials reported that no side effects or adverse events

were observed by investigators or parents during the treatment period.

Functional Abdominal Pain

Asgarshirazi et al[42] investigated the efficacy of peppermint oil in the treatment of functional abdominal pain disorders. A total of 120 participants were treated either with Colpermin capsules or probiotic tablets, or folic acid tablets as the placebo. When compared with the placebo, peppermint oil significantly reduced the duration of pain (minutes/day), frequency of pain (episodes per week), and severity of pain. In comparison with probiotics, peppermint oil significantly reduced the duration of pain (minutes/day) and the severity of pain.

Asgarshirazi et al[42] stated that no adverse events or side effects occurred as a result of peppermint oil use and probiotics during the study period.

Constipation

Quitadamo et al[43] studied an herbal compound of acacia fiber and psyllium fiber versus a solution of polyethylene glycol and electrolytes in the treatment of constipation in 100 children. Compliance rates were significantly higher in children treated with the solution of polyethylene glycol and electrolytes (96%) compared with children treated with the herbal compound (72%). No significant differences between both groups were observed in primary or secondary study outcomes.

No serious side effects or adverse events were observed by the authors during the study period.

DISCUSSION

Summary of Evidence

This analysis indicates an emerging evidence base for the use of certain herbal medicines for conditions such as diarrhea, dehydration, infantile colic, IBS, and functional abdominal pain. *P erecta*, carob bean juice, and an herbal compound preparation including *M chamomilla* and apple pectin (Diarrhoesan) were shown to significantly reduce the duration of symptoms in children suffering from diarrhea. This review also demonstrated that peppermint oil (Colpermin) can decrease duration, frequency, and severity of pain in children suffering from undifferentiated functional abdominal pain, whereas Colpermin showed no effects in treating children and adolescents with IBS exclusively. Furthermore, evidence was found for different fennel preparations (eg, oil, tea, herbal compound ColiMil) in treating children with infantile colic. This review also found that psyllium fiber may be a useful adjunct in treating children with constipation and in decreasing pain episodes in patients with IBS. However, research evaluating the efficacy and safety of herbal medicine for gastrointestinal disorders in children is in its infancy. Because the number of included RCTs for the different herbs and indications was small, future rigorous RCTs might change the existing conclusions.

Agreements With Previous Systematic Reviews

Two previously conducted systematic reviews failed to locate any systematic reviews on the use of herbal medicine for gastrointestinal disorders in children.[44,45] A previous literature review of herbal medicine use in children included 90 clinical studies, of which one-third were conducted in China in children with respiratory disorders.[46] A further 18 studies were located that investigated the use of herbal medicine for gastrointestinal disorders, however only 2 clinical studies of garlic for diarrhea were mentioned in the results. Although the review found that RCTs are feasible with children, the authors noted that few high-quality trials were identified.[46]

Strengths and Weaknesses

There are several limitations to this systematic review. Although aligning our methodology with guidelines from the Cochrane Collaboration strengthens rigor overall and decreases risk of bias, it also means that early-stage, non-RCTs of herbal medicines were not captured. Although this was the intent, it was designed to exclude trial designs that may give preliminary insights into an understudied area and emerging field of research. Secondly, many RCTs that were included in this systematic review were small trials with between 30 and 100 participants and larger trials are warranted to further examine efficacy and safety of herbal medicine for gastrointestinal disorders in the pediatric population. Thirdly, most of the studies revealed no adverse events, calling into question the way that adverse events information was collected and recorded. A number of studies did not indicate whether information on adverse events was collected.

Implications for Further Research

It is difficult to make a strong recommendation for the use of herbal medicine for gastrointestinal disorders in children when the evidence base is only just emerging. Large-scale trials are needed to further investigate early positive results presented here; however, research in herbal medicine faces many challenges when compared with the study of synthetic drugs. Many herbal medicines are not standardized with batch-to-batch and label-to-label variations because of various elements such as growing conditions, manufacturing processes, and differing formulations. In addition to this, there are many ethical[47] and clinical hurdles involved in studying the use of herbal medicine in children. Despite

these challenges, additional well-designed trials are required to build an adequate evidence base and give accurate information on dosing to assist clinical decision-making and ensure the safe use of herbal medicine for children.

Implications for Clinical Practice

A recent study found that over two-thirds of children attending gastroenterology outpatient clinics at a tertiary pediatric hospital were using complementary medicine including herbal medicine.[48] The vast majority of parents surveyed (80%) felt that medical professionals should support the use of CAM.[48] Medical professionals could recommend the use of herbal medicines that have been shown to be safe and effective as a first-line measure to parents who have expressed interest in trying CAM for their children. Herbal medicines such as *P erecta* (tormentil), carob bean juice, and Diarrhoesan for diarrhea; peppermint oil (Colpermin) for functional abdominal pain; fennel preparations (eg, oil, tea, herbal compound ColiMil) for treating infantile colic; and psyllium fiber can be used as an adjunct while treating constipation in children with IBS. Currently, most herbal medicine used by children is parent initiated and often not disclosed to a primary health care professional, leading to concerns about safety, herb–drug interactions and inadequate treatment.[49] This revelation underscores the need to have open and nonjudgmental conversations with parents about the use of herbal medicine to ensure safe, coordinated patient care.

ABBREVIATIONS

CAM: complementary and alternative medicine
IBS: irritable bowel syndrome
RCT: randomized controlled trial

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