The Turkish Journal of Pediatrics 2026; 68: 369-380
https://doi.org/10.24953/turkjpediatr.2026.6619

Original Article

Functional gastrointestinal disorders in Turkish infants: impact of feeding practices, sleep quality, and maternal depression

Betül Yıldırım[1], Egemen Tural[2], Nevzat Aykut Bayrak[3], Özlem Erdede[4]

[1]Department of Pediatrics, Freelance Pediatrician, İstanbul, Türkiye; [2]Department of Family Medicine, Çifteler State Hospital, Eskişehir, Türkiye; [3]Department of Pediatric Gastroenterology, Hepatology and Nutrition, Medipol Acıbadem Regional Hospital, İstanbul, Türkiye; [4]Department of Pediatrics, Zeynep Kamil Women and Children Diseases Training and Research Hospital, University of Health Sciences, İstanbul, Türkiye.

ABSTRACT

Background. Functional gastrointestinal disorders (FGIDs) significantly impact infant well- being and healthcare utilization, yet comprehensive data using updated Rome IV criteria in Turkish populations remains limited. Our objective was to determine the prevalence and characteristics of FGIDs in Turkish infants and examine associations with feeding patterns, sleep quality, and maternal depression.

Methods. A cross-sectional study was conducted in a tertiary hospital between February and August 2020. A total of 459 infants aged 1–12 months were enrolled. FGIDs were diagnosed according to Rome IV criteria. Feeding characteristics, sleep quality assessed by the Brief Infant Sleep Questionnaire, and maternal depression measured using the Edinburgh Postnatal Depression Scale were recorded through face-to-face interviews. Comparisons were primarily performed between infants with and without FGIDs. Multivariable logistic regression adjusted for infant age was used to evaluate the association between feeding type and FGIDs.

Results. At least one FGID was identified in 53.2% of infants (n=244). Co-occurrence of multiple FGIDs was observed in 92 infants. Infants with FGIDs were significantly younger than those without FGIDs with a median age of 3 months (interquartile range [IQR]: 2–5) vs 6 months (IQR: 3–9) (p<0.001). Poor sleep was markedly more prevalent among infants with FGIDs compared to those without (45.1% vs 22.3%, p<0.001). Mothers of infants with FGIDs had higher depression scores than mothers of infants without FGIDs (median: 7.0 [IQR: 4–11] vs 5.0 [3–10], p=0.030). In multivariable logistic regression analysis adjusted for infant age, the overall feeding model was not statistically significant (p=0.240); however, mixed breast milk and formula feeding was associated with increased FGID risk compared to exclusive breastfeeding (adjusted odds ratio: 2.16, 95% confidence interval: 1.17-3.98, p=0.014).

Conclusions. FGIDs affect over half of Turkish infants and are associated with sleep disturbances and maternal depressive symptoms. Mixed breast-formula feeding independently increased FGID risk after age adjustment. Integrated care approaches addressing feeding practices, sleep quality, and maternal mental health are warranted.

Key words: gastrointestinal diseases, postpartum depression, infant, newborn, sleep, breast feeding.

✉ Egemen Tural ▪ egementural1@gmail.com

Received 11th Jul 2025, revised 8th Jan 2026, 9th Jan 2026, 21st Mar 2026, accepted 25th Mar 2026.

This study was derived from the medical residency thesis of Betül Yıldırım, entitled "Functional Gastrointestinal Disorders in Infants and Associated Factors", prepared under the supervision of Dr. Özlem Erdede and co-supervision of Dr. Nevzat Aykut Bayrak at the Department of Pediatrics, University of Health Sciences, Zeynep Kamil Women and Children's Diseases Training and Research Hospital, in 2021.

Functional gastrointestinal disorders (FGIDs) are a major group of conditions that cause ongoing symptoms related to gut-brain axis development, which cannot be explained by any biochemical or structural abnormalities.[1,2] In young children, limited ability to express discomfort results in symptoms such as recurrent crying, irritability, and vomiting, causing substantial concern among caregivers.[3] Although FGIDs in childhood are not life threatening, delayed diagnosis and treatment may lead to physical and emotional stress.[2] Studies have shown that infants with FGIDs have a lower quality of life and increased rates of hospital visits.[4] Additionally, the unnecessary utilization of healthcare services and the use of inappropriate treatments during the diagnostic process represent significant challenges.[5]

FGID diagnoses rely on symptom-based Rome IV criteria, with infant regurgitation (IR), infantile colic (IC), and functional constipation (FC) as the most frequently observed conditions in neonates and infants.[3,6,7] Knowledge concerning dyschesia (ID) is notably limited, leading to potential misdiagnosis as IC or FC.[7] Although the pathogenesis of FGIDs is not fully understood, genetics, sociocultural effects, and the microbiome are all thought to have a role.[6] Furthermore, FGIDs have been linked to sleep problems and maternal depression.[8-10] However, investigations on the aspects that contribute to the development of FGIDs are sparse and yield conflicting results.

Previous research has examined individual FGIDs and their associated factors; however, there is limited data on the prevalence and co-occurrence of multiple FGIDs in Turkish infants using the updated Rome IV criteria. The relationship between FGIDs and varying cultural factors such as feeding traditions, sleep patterns, and maternal mental health requires further investigation.[11]

The feeding methods for Turkish infants and the prevailing family structures may influence the prevalence of FGIDs and related factors in ways that differ from those observed in Western countries, where extensive research has been conducted. Understanding these interactions is essential for developing culturally relevant national preventative and management strategies.

The aim of this study was to determine the prevalence and characteristics of FGIDs in Turkish infants and to evaluate their associations with feeding practices, sleep quality, and maternal depression.

Materials and Methods

Study design and setting

This was a single-center cross-sectional study conducted at a tertiary center specializing in obstetrics, gynecology, newborn and pediatric care from February 2020 to August 2020. The study included children between the ages of 1 and 12 months who were admitted to the hospital during this timeframe.

Ethical approval

Ethical approval was obtained from the Ethics Committee of the University of Health Sciences, Zeynep Kamil Women and Children's Diseases Training and Research Hospital on January 20, 2020 (Decision No: 17). The study was conducted in accordance with the principles of the Declaration of Helsinki. Prior to data collection, all participating mothers provided written informed consent.

Data collection

Study data were collected using a structured questionnaire administered to mothers after consent was obtained. The questionnaire included information regarding sociodemographic characteristics, medical history, and relevant clinical factors.

Study population and exclusion criteria

As a tertiary care institution with an average annual birth volume of approximately 3,500, the hospital routinely conducts longitudinal follow-up of healthy infants up to 12 months of age through its well-baby outpatient clinic if preferred by the parents. Within the scope of this follow-up, infants presenting with various complaints are also systematically evaluated as part of standard pediatric surveillance. Infants were enrolled consecutively; those with known chronic illnesses, a history of extreme or very preterm birth, a confirmed diagnosis of cow's milk protein allergy, or failure to pass meconium within the first 48 hours of life were excluded from the study.

Data collection and group classification

The questionnaire used in the study included items on the child's feeding method, feeding frequency and duration, defecation characteristics, and gastrointestinal symptoms if present. Additionally, demographic characteristics, the infant's sleep patterns, and maternal depression assessment were recorded. Assessments were performed during routine visits, with evaluation timing documented in relation to the infant's age. Mothers were instructed to report symptoms and behaviors from the previous two weeks to reduce recall bias. Interviews were carried out in a private setting to promote open dialogue regarding sensitive subjects, including maternal mood and infant behavior.

Data were gathered on breastfeeding, formula feeding, and the utilization of complementary foods; the duration of exclusive breastfeeding; the timing of the introduction of complementary foods and wheat-containing products; the consumption of milk beyond breast milk or formula; feeding frequency; and the methods of feeding employed.

Maternal depression was assessed using the Edinburgh Postnatal Depression Scale (EPDS), which has been validated and shown to be reliable in the Turkish population by Aydın et al., with a cut-off score of ≥13 indicating probable depression.[12,13] To evaluate the children's sleep quality, the "Brief Infant Sleep Questionnaire (BISQ)" validated for Turkish children was utilized. Infants who woke more than three times during the night, had a total sleep duration of less than 9 hours, or experienced night awakenings lasting longer than 1 hour were classified as poor sleepers according to established criteria.[14,15]

Participants were categorized into two mutually exclusive groups: infants with at least one FGID and infants without FGIDs. All primary analyses were conducted based on this dichotomous classification. The two groups were compared with respect to the variables that were available in the dataset and presented in the results: infant age, sex, birth weight, current weight SDS, feeding interval, duration of exclusive breastfeeding, overall feeding type, infant sleep characteristics, and maternal depression scores.

Statistical analysis

The calculation of sample size was predicted on an anticipated FGID prevalence of 30%[5,6], with a precision of ±4% and a confidence level of 95%, necessitating a minimum of 504 participants. Data were analyzed using IBM SPSS Statistics for Windows version 21.0 (IBM Corp., Armonk, NY, USA). The normality of data distribution was assessed by the Kolmogorov-Smirnov test. Continuous variables were presented as mean ± standard deviation when normally distributed, and as median and interquartile range (IQR: Q1–Q3) when not normally distributed. Categorical variables were expressed as frequencies and percentages (%).

Continuous variables were summarized as median and interquartile range and compared between two independent groups (FGID vs No-FGID) using the Mann–Whitney U test. Categorical variables were expressed as frequencies and percentages and analyzed using the chi-square test; when chi-square test assumptions were not met, Fisher's exact test was applied. The association between feeding type and the presence of any FGID was evaluated using multivariable logistic regression analysis adjusted for infant age. Feeding type was included as a categorical independent variable with exclusive breastfeeding as the reference category. Results of logistic regression analyses were reported as odds ratios (OR) with 95% confidence intervals (CI). A two-sided p-value <0.05 was considered statistically significant.

Results

Of 557 consecutive infants aged 1-12 months presenting during the study period, 98 were excluded for the following reasons: chronic diseases (n=23), extreme or very preterm birth <32 weeks (n=18), confirmed cow's milk protein allergy (n=31), failure to pass meconium within 48 hours (n=12), and parental refusal to participate (n=14). The final analysis included 459 infants (mean age: 5 ± 3.1 months, mean birth weight: 3.3 ± 0.5 kg, 46.2% female). The sample size of 459 yields 80% power to identify odds ratios of 1.8 or higher for binary exposures with a prevalence of 30%.

Vaginal delivery accounted for 42.3% (n = 194) of births, while cesarean section accounted for 57.7% (n = 265). The mean age of the mothers was 29.0 ± 5.0 years. Regarding hospital visit reasons, 30.5% (n = 140) of participants presented with complaints related to FGIDs, whereas 69.5% (n = 319) presented for other reasons.

Age-stratified analysis revealed that FGID prevalence was highest in infants aged 1-3 months (68.2%, n=156/229), decreased in those aged 4-6 months (45.3%, n=72/159), and was lowest in infants aged 7-12 months (22.5%, n=16/71) (p<0.001 for trend). Co-occurrence of multiple FGIDs was observed in 92 infants, corresponding to approximately 37.7% of those with any FGID. The most common co-occurring FGIDs were combinations of infant regurgitation with infantile colic and infant regurgitation with infant dyschezia. The prevalence of FGIDs and their co-occurrence frequencies are presented in Table I.

Feeding patterns showed that 45.3% (n=208) of infants were exclusively breastfed, 16.1% (n=74) received both breast milk and formula, 2.6% (n=12) were exclusively formula-fed, 29.2% (n=134) received breast milk and complementary foods, and 6.8% (n=31) consumed formula and complementary foods. Additionally, 42.3% (n=194) of the infants used pacifiers. Comparison of participants' demographic characteristics and feeding features is presented in Table II.

Table I. Frequency and co-occurrence of functional gastrointestinal disorders

	n	%
Functional gastrointestinal disorders		
Infant regurgitation	161	35.1
Infantile colic	97	21.1
Infant dyschezia	91	19.8
Rumination	18	3.9
Functional constipation	8	1.7
Functional diarrhea	2	0.4
Cyclic vomiting	0	0.0
Co-occurrence of functional gastrointestinal disorders		
Infantile colic + Infant dyschezia	11	2.3
Infant regurgitation + Infantile colic	36	7.8
Infant regurgitation + Infant dyschezia	24	5.2
Infant regurgitation + Infantile colic + Infant dyschezia	21	4.6

The total number of infants with any FGID was 244. Individual FGID subtypes are not mutually exclusive, as some infants met criteria for more than one FGID. Therefore, the sum of subtype frequencies exceeds the total number of affected infants.
FGID: Functional gastrointestinal disorder.

Table II. Demographic and feeding characteristics of the participants

Characteristics	FGID (n=244)	No FGID (n=215)	p
Age (months), median (IQR)	3.0 (2-5)	6.0 (3-9)	<0.001[z]
Birth weight (kg), median (IQR)	3.3 (2.9-3.6)	3.4 (3.0-3.6)	0.062[z]
Current weight SDS, median (IQR)	0.07 (-0.8-0.7)	0.05 (-0.6-0.8)	0.469[z]
Sex, n (%)			0.149[c]
Male	139 (57.0)	108 (50.2)	
Female	105 (43.0)	107 (49.8)	
Birth weight category, n (%)			0.760[c]
Normal	216 (88.5)	187 (87.0)	
Low birth weight	17 (7.0)	15 (7.0)	
Macrosomia	11 (4.5)	13 (6.0)	
Feeding interval, n (%)			0.037[c]
Every hour	33 (13.5)	15 (7.0)	
Every 2–3 hours	103 (42.2)	84 (39.0)	
More than 3 hours	21 (8.6)	30 (14.0)	
On demand	87 (35.7)	86 (40.0)	
Duration of exclusive breastfeeding, n (%)			<0.001[c]
6 months	18 (7.4)	53 (24.7)	
4-6 months	49 (20.1)	68 (31.6)	
<4 months	132 (54.1)	68 (31.6)	
>6 months	12 (4.9)	16 (7.4)	
Never breastfed	33 (13.5)	10 (4.7)	

[z]: Mann-Whitney U test; [c]: Chi-square test.
FGID: Functional gastrointestinal disorder; IQR: Interquartile range (Q1–Q3)

Crude analyses suggested associations between certain feeding patterns and the presence of FGIDs; however, most of these associations attenuated after adjustment for infant age. In multivariable logistic regression analysis adjusted for age, the overall feeding model was not statistically significant (p=0.240). Nevertheless, examination of individual feeding categories revealed that mixed breast milk and formula feeding remained significantly associated with increased FGID risk compared to exclusive breastfeeding (adjusted OR: 2.16, 95% CI: 1.17–3.98, p=0.014). Other feeding patterns showed no significant associations after age adjustment. Estimates for the "formula only" group (n=12) were unstable due to sparse data and are not reported (Table III).

A statistically significant difference was observed between the groups regarding mothers' perception of their infant's sleep (p=0.022), with mothers of infants with FGIDs more likely to perceive their infant's sleep as a serious or minor problem compared to those without FGIDs. Similarly, infants with FGIDs were significantly more likely to meet the criteria for poor sleep (p<0.001).

In addition, maternal depression scores differed significantly between the groups (p=0.030), with higher median scores observed among mothers of infants with FGIDs. Detailed sleep characteristics and maternal depression scores are presented in Table IV.

Table III. Logistic regression analysis: effect of feeding type on risk of functional gastrointestinal disorders

Feeding type	Crude OR (95% CI)	p	Adjusted OR# (95% CI)	p
Exclusive breastfeeding (reference)	1.00	–	1.00	–
Breast milk + Formula	2.07 (1.14–3.76)	0.018	2.16 (1.17–3.98)	0.014
Formula only*	–	0.999	–	0.999
Breast milk + Complementary food	0.33 (0.19–0.56)	<0.001	1.32 (0.58–2.97)	0.506
Breast milk + Complementary food + Formula	0.32 (0.17–0.62)	0.001	1.35 (0.54–3.38)	0.523
Formula + Complementary food	0.19 (0.08–0.47)	<0.001	0.91 (0.30–2.78)	0.864

While the overall model was not statistically significant (p=0.240), indicating limited overall explanatory power of feeding type after age adjustment, individual comparison revealed that mixed breast milk and formula feeding was significantly associated with increased functional gastrointestinal disorder risk (p=0.014) compared to exclusive breastfeeding. Crude model: p<0.001, Adjusted model: p=0.240

Adjusted for infant age (months)

*Estimates for the "formula only" group (n = 12) were unstable due to sparse data and are therefore not interpretable.

CI: confidence interval, OR: odds ratio.

Table IV. Sleep characteristics of participants and comparison of maternal depression scores

Characteristics	FGID (n = 244)	No FGID (n = 215)	p
Mother's perception of infant's sleep, n (%)			0.022[c]
A very serious problem	28 (11.5)	15 (7.0)	
A minor problem	86 (35.2)	59 (27.4)	
Not a problem at all	130 (53.3)	141 (65.6)	
Meets poor sleep criteria, n (%)			<0.001[c]
Yes	110 (45.1)	48 (22.3)	
No	134 (54.9)	167 (77.7)	
Maternal depression score, median (IQR)	7.0 (4-11)	5.0 (3-10)	0.030[z]

[c] Chi-square test. [z]: Mann-Whitney U test

FGID: Functional gastrointestinal disorder; IQR: Interquartile range (Q1–Q3).

Discussion

In our study, at least one FGID was identified in 53.2% (n = 244) of the 459 children included. Among the evaluated children, 161 (35.1%) had IR, 97 (21.1%) had IC, and 91 (19.8%) had ID. FGIDs are known to be influenced by biological, psychosocial, and social factors: cultural practices, dietary and bowel habits, and perceptions of symptoms vary across cultures.[11] Differences in geography and cultural background may therefore contribute to variations in the distribution of FGID. Additionally, the higher prevalence observed in our study may be due to the younger age group of our study population and the fact that our hospital serves as a referral center in the region with a pediatric gastroenterology specialist, potentially leading to a higher concentration of children presenting with FGID symptoms. Multivariable analysis adjusted for infant age revealed important nuances in the feeding-FGID relationship. While the overall feeding model was not statistically significant (p=0.240), mixed breast milk and formula feeding emerged as a specific risk factor for FGIDs (adjusted OR: 2.16, p=0.014), independent of infant age. In contrast, the apparent protective associations observed with complementary food introduction in crude analyses became non-significant after age adjustment, suggesting these associations were largely confounded by infant maturation rather than reflecting direct effects of solid food introduction. The persistent significant association between mixed feeding and FGIDs may reflect gut microbiome instability from alternating between breast milk and formula, incomplete enzymatic adaptation to formula proteins, or disruption of immune tolerance mechanisms.

In a study by van Tilburg et al., which included 264 children aged 0–3 years and utilized the Rome III criteria, at least one FGID was identified in 27.1% of children and at least two FGIDs in 3.4%.[4] In a 2016 review by Ferreira-Maia et al., the reported prevalence of at least one FGID ranged from 27.1% to 38%, while the prevalence of at least two FGIDs was reported as 20.8%.[5] In our study, co-occurrence of multiple FGIDs was observed in 92 infants, corresponding to 37.7% of those with any FGID. This substantial overlap suggests that FGIDs may share common underlying mechanisms and that these conditions should be evaluated within a broader, integrated clinical framework rather than as entirely separate entities.

The higher prevalence of FGID in our study population compared to Western cultures could be attributed to cultural differences in baby care methods, dietary patterns, and symptom interpretation. Turkish families generally have close physical touch with their infants and may be more inclined to identify subtle behavioral changes as worrisome symptoms. Furthermore, extended family involvement in newborn care may affect feeding habits and symptom identification. These cultural characteristics should be taken into account when translating our findings to other populations and devising culturally relevant intervention options. Future studies should look explicitly at how cultural practices affect FGID prevalence and outcomes.

When examining the mean age of participants, the median age of infants with FGIDs was significantly lower than that of those without FGIDs. Previous studies have also shown that the prevalence of FGIDs is inversely proportional to age.[16,17]The relationship between age distribution and FGIDs in our study is consistent with findings in the literature. In summary, the frequency of FGIDs decreases as age increases in children under 1 year of age.

Similarly, in studies conducted by van Tilburg et al. and Steutel et al., no significant difference was found between male and female infants regarding the presence of FGIDs, consistent with our findings.[4,16] In contrast, a 2015 review by Korterink et al., which included children aged 4–18 years, found that functional abdominal pain was significantly more common in girls. This finding was attributed to depression, anxiety, and stressful life events.[18] The absence of sex-related differences in FGID prevalence in our study and in two other studies involving children aged 0–1 year may be explained by the younger age of the population and the fact that these children are less likely to have been exposed to psychosocial stressors.

The relationship between breastfeeding and FGIDs has been investigated in several studies. Steutel et al. compared formula feeding and formula plus complementary feeding to exclusive breastfeeding and found a higher risk of FGIDs among infants fed with formula or formula plus complementary foods.[16] Chew et al., in a study conducted in Malaysia, reported a significantly lower incidence of IR in breastfed infants.[19] Kramer et al. observed that breastfed infants at 1 and 3 months of age experienced significantly less ID, although this difference was no longer apparent at 9 months.[20] Cohen Engler et al. noted fewer episodes of crying in breastfed infants compared to those fed formula.[21]

The non-significant overall feeding model ($p=0.240$) indicates that, when age is properly accounted for, feeding patterns as a whole explain limited variance in FGID occurrence compared to developmental maturation. However, the identification of mixed breast-formula feeding as an independent risk factor has important clinical implications: while exclusive breastfeeding or consistent formula feeding allows the infant's gut to adapt to a single feeding source, alternating between the two may prevent the establishment of a stable intestinal microbiome and enzymatic systems. Healthcare providers should be aware that infants on mixed feeding regimens may be at higher risk for FGIDs, and when supplementation is necessary, consistent feeding patterns may be preferable to frequent alternation.

Although several biological mechanisms have been proposed to explain how breastfeeding might influence gastrointestinal function, human milk oligosaccharides exert prebiotic effects, and fermentation of breast milk produces short-chain fatty acids, which are thought to enhance gastrointestinal motility and may be linked to these disorders.[22] Additionally, increased melatonin levels transmitted through breastfeeding help regulate circadian rhythms, which may modulate FGID symptoms such as infantile colic.[23] However, in our study, these potential mechanisms were not supported by the adjusted analyses, as feeding type was not independently associated with FGIDs after controlling for infant age. Therefore, while the biological plausibility remains, our findings suggest that developmental and age-related factors may play a more dominant role in the occurrence of FGIDs during early infancy.

Previous studies have suggested that feeding practices and patterns may influence gastrointestinal symptoms in early infancy. Proposed mechanisms include increased air swallowing during frequent feeding, rapid gastric emptying related to high foremilk intake, and physiological immaturity of intestinal regulation during the first months of life.[24,25] These mechanisms remain biologically plausible and may contribute to symptom perception in individual infants.

However, in our study, after restructuring the analyses to focus on the comparison of infants with and without FGIDs and adjusting for infant age, feeding-related variables were not found to be independently associated with FGIDs. Therefore, although feeding counseling remains an important component of routine pediatric care, our findings do not support recommending specific feeding patterns solely for the prevention of FGIDs. Instead, clinical management should consider the multifactorial nature of FGIDs, including developmental factors, sleep quality, and maternal well-being.

FGIDs are frequently observed in conjunction with sleep disturbances.[26] A 2012 study conducted on children aged 8 to 17 years with FGIDs reported that 45% of these children experienced difficulties initiating or maintaining sleep.[27] One of the key components of the circadian rhythm is the sleep-wake cycle, which can be disrupted by environmental factors that obscure the distinction between day and night, thereby affecting sleep quality.[28] Additionally, studies have demonstrated that biological rhythms influence colonic motility.[29] The natural decline in FGID symptoms during early infancy, particularly after the first months of life when circadian rhythms become more established, has led to the hypothesis that circadian rhythm desynchronization may contribute to the pathophysiology of early-life FGIDs.[23] Supporting this view, İnce et al. demonstrated that morning melatonin levels were significantly higher in healthy controls compared to infants with colic symptoms.[23]

Regarding the relationship between sleep and FGIDs, our study demonstrated significant differences between infants with and without FGIDs. Mothers of infants with FGIDs were more likely to perceive their infant's sleep as a serious or minor problem compared to mothers of infants without FGIDs. According to the BISQ used in our study, infants who woke more than three times per night, had more than one hour of nighttime wakefulness, or slept less than nine hours per day were classified as having poor sleep.[14] The proportion of infants meeting these poor sleep criteria was significantly higher among infants with FGIDs compared to those without FGIDs.

Previous studies examining the relationship between sleep and FGIDs have reported mixed results. James-Roberts et al. reported that infants with gastrointestinal complaints slept significantly less than healthy controls, supporting an association between sleep problems and FGIDs.[30] In contrast, Brand et al., in a smaller cohort, did not observe a significant relationship between sleep patterns and colic symptoms.[31] While further research is needed in this area, it is believed that sleep disturbances may exacerbate FGID symptoms. Therefore, the relationship between poor sleep and FGIDs suggests that sleep assessment should be routine in infants presenting with gastrointestinal symptoms. Simple interventions to improve infant sleep hygiene may have dual benefits for both sleep quality and FGID symptoms.

Maxted et al., in interviews with 93 mothers attending a Colic Clinic, observed depressive symptoms in 45.2% of the mothers.[32] In another study involving 1,015 mothers, both infants and mothers were evaluated at 2 and 6 months postpartum. It was found that mothers of infants with colic had significantly higher EPDS scores at 2 months and at 6 months—when colic symptoms had resolved—compared to the control group.[10] In our study, mothers of infants with FGIDs had significantly higher depression scores compared to mothers of infants without FGIDs. These findings support the growing evidence that infant gastrointestinal problems and maternal mental health are closely interrelated, emphasizing the importance of considering maternal well-being in the comprehensive management of FGIDs.

Maternal postpartum depression is often overlooked. Considering the relationship between maternal postpartum depression and FGIDs, a thorough assessment of maternal mood, especially in the early months of life, would be beneficial for both infant and maternal health. Most importantly, our findings on maternal depression highlight the need for integrated care approaches. Pediatric practitioners should consider screening for maternal mental health issues, as addressing maternal depression may improve both maternal well-being and infant outcomes.

Our findings are consistent with those of the large-scale, multicenter study conducted in Turkey by Beser et al., which reported a high prevalence of FGIDs during the first six months of life.[33] However, our study extends the existing literature by incorporating psychosocial variables that were not evaluated in that previous investigation. In particular, we demonstrated that mothers of infants with FGIDs had significantly higher depression scores compared to mothers of infants without FGIDs, underscoring the potential psychological impact of infant gastrointestinal symptoms on caregivers. Furthermore, our results revealed a significant association between FGIDs and poor sleep quality, highlighting the importance of considering sleep disturbances in the clinical evaluation of these conditions. Unlike the earlier study, which primarily focused on prevalence and feeding patterns[33], our investigation provides a more comprehensive assessment that includes behavioral and psychosocial dimensions. Therefore, our study contributes novel and clinically relevant data to the understanding of FGIDs in Turkish infants and supports the need for a holistic approach in their diagnosis and management.

Limitations include the single-center design, the hospital's status as a referral center for pediatric gastroenterology which may have led to a higher proportion of patients with gastroenterological complaints, reliance on maternal self-reporting, and the subjective nature of maternal perceptions of time and infant discomfort. To our knowledge, this study is among the few in the literature to address these aspects comprehensively. The strengths of our study include the use of up-to-date Rome IV criteria, assessment of all FGIDs within the 1-12 month age range, face-to-face interviews with mothers, and evaluation of feeding, sleep, sociodemographic characteristics, and maternal depression as factors potentially related to FGIDs.

We believe our study raises awareness about FGIDs and provides guidance for larger-scale research on the prevalence of FGIDs in Turkish children, as well as on key related psychosocial factors such as infant sleep patterns and maternal mental health.

Conclusion

In conclusion, this study provides comprehensive information on the prevalence and clinical correlates of FGIDs in Turkish infants. Our findings demonstrate significant associations between FGIDs, poor infant sleep, and higher maternal depressive symptoms, highlighting the multifactorial nature of these disorders. Although crude analyses suggested associations between several feeding patterns and FGIDs, these relationships largely attenuated after adjustment for infant age. In age-adjusted multivariable analysis, feeding type as a whole was not independently associated with FGIDs. Nevertheless, category-level analysis indicated that mixed breast milk and formula feeding was associated with an increased risk of FGIDs compared to exclusive breastfeeding, suggesting that certain feeding patterns may still be relevant in specific contexts. The observed relationships with sleep disturbances and maternal mental health emphasize the importance of a holistic approach to the assessment and management of affected infants.

These results support the implementation of integrated care models in clinical practice that include routine evaluation of infant sleep patterns and screening for maternal mental health problems. Such approaches may help improve symptom management and overall family well- being during the crucial early months of infant development. Future research should prioritize longitudinal studies and intervention trials to clarify causal relationships and to evaluate the effectiveness of integrated prevention and management strategies. Understanding the mechanisms underlying these associations will be essential for developing evidence-based interventions adaptable to different cultural contexts.

Ethical approval

The study was approved by Ethics Committee of the University of Health Sciences, Zeynep Kamil Women and Children's Diseases Training and Research Hospital (date: January 20, 2020, number: 17).

Author contribution

The authors confirm contribution to the paper as follows: Study conception and design: BY, ÖE, NAB; data collection: BY; analysis and interpretation of results: BY, NAB, ET; draft manuscript preparation: BY, ET, NAB, ÖE. Supervisor: NAB. All authors reviewed the results and approved the final version of the article.

Source of funding

The authors declare the study received no funding.

Conflict of interest

The authors declare that there is no conflict of interest.

REFERENCES

1. Mostafa R. Rome III: The functional gastrointestinal disorders, third edition, 2006. World J Gastroenterol 2008; 14: 2124–2125. https://doi.org/10.3748/wjg.14.2124
2. Benninga MA, Faure C, Hyman PE, St James Roberts I, Schechter NL, Nurko S. Childhood functional gastrointestinal disorders: neonate/toddler. Gastroenterology 2016; 150: 1443-1455.e2. https://doi.org/10.1053/j.gastro.2016.02.016
3. Zeevenhooven J, Koppen IJ, Benninga MA. The new Rome IV criteria for functional gastrointestinal disorders in infants and toddlers. Pediatr Gastroenterol Hepatol Nutr 2017; 20: 1-13. https://doi.org/10.5223/pghn.2017.20.1.1
4. van Tilburg MA, Hyman PE, Walker L, et al. Prevalence of functional gastrointestinal disorders in infants and toddlers. J Pediatr 2015; 166: 684-689. https://doi.org/10.1016/j.jpeds.2014.11.039

5. Ferreira-Maia AP, Matijasevich A, Wang YP. Epidemiology of functional gastrointestinal disorders in infants and toddlers: a systematic review. World J Gastroenterol 2016; 22: 6547-6558. https://doi.org/10.3748/wjg.v22.i28.6547

6. Koppen IJ, Nurko S, Saps M, Di Lorenzo C, Benninga MA. The pediatric Rome IV criteria: what's new? Expert Rev Gastroenterol Hepatol 2017; 11: 193-201. https://doi.org/10.1080/17474124.2017.1282820

7. Vandenplas Y, Abkari A, Bellaiche M, et al. Prevalence and health outcomes of functional gastrointestinal symptoms in infants from birth to 12 months of age. J Pediatr Gastroenterol Nutr 2015; 61: 531-537. https://doi.org/10.1097/MPG.0000000000000949

8. Hyun MK, Baek Y, Lee S. Association between digestive symptoms and sleep disturbance: a cross-sectional community-based study. BMC Gastroenterol 2019; 19: 34. https://doi.org/10.1186/s12876-019-0945-9

9. Maneerattanaporn M, Chey WD. Sleep disorders and gastrointestinal symptoms: chicken, egg or vicious cycle? Neurogastroenterol Motil 2009; 21: 97-99. https://doi.org/10.1111/j.1365-2982.2008.01254.x

10. Vik T, Grote V, Escribano J, et al. Infantile colic, prolonged crying and maternal postnatal depression. Acta Paediatr 2009; 98: 1344-1348. https://doi.org/10.1111/j.1651-2227.2009.01317.x

11. Chuah KH, Mahadeva S. Cultural factors influencing functional gastrointestinal disorders in the east. J Neurogastroenterol Motil 2018; 24: 536-543. https://doi.org/10.5056/jnm18064

12. Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. Br J Psychiatry 1987; 150: 782-786. https://doi.org/10.1192/bjp.150.6.782

13. Aydin N, Inandi T, Yigit A, Hodoglugil NNS. Validation of the Turkish version of the Edinburgh Postnatal Depression Scale among women within their first postpartum year. Soc Psychiatry Psychiatr Epidemiol 2004; 39: 483-486. https://doi.org/10.1007/s00127-004-0770-4

14. Sadeh A. A brief screening questionnaire for infant sleep problems: validation and findings for an Internet sample. Pediatrics 2004; 113: e570-e577. https://doi.org/10.1542/peds.113.6.e570

15. Boran P, Ay P, Akbarzade A, Küçük S, Ersu R. Translation into Turkish of the expanded version of the "Brief Infant Sleep Questionnaire" and its application to infants. Marmara Med J 2015; 27: 178-183. https://doi.org/10.5472/MMJ.2014.03606.2

16. Steutel NF, Zeevenhooven J, Scarpato E, et al. Prevalence of functional gastrointestinal disorders in European infants and toddlers. J Pediatr 2020; 221: 107-114. https://doi.org/10.1016/j.jpeds.2020.02.076

17. Campeotto F, Barbaza MO, Hospital V. Functional gastrointestinal disorders in outpatients aged up to 12 months: a French non-interventional study. Int J Environ Res Public Health 2020; 17: 4031. https://doi.org/10.3390/ijerph17114031

18. Korterink JJ, Diederen K, Benninga MA, Tabbers MM. Epidemiology of pediatric functional abdominal pain disorders: a meta-analysis. PLoS One 2015; 10: e0126982. https://doi.org/10.1371/journal.pone.0126982

19. Chew KS, Em JM, Koay ZL, et al. Low prevalence of infantile functional gastrointestinal disorders (FGIDs) in a multi-ethnic Asian population. Pediatr Neonatol 2021; 62: 49-54. https://doi.org/10.1016/j.pedneo.2020.08.009

20. Kramer EAH, den Hertog-Kuijl JH, van den Broek LMCL, et al. Defecation patterns in infants: a prospective cohort study. Arch Dis Child 2015; 100: 533-536. https://doi.org/10.1136/archdischild-2014-307448

21. Cohen Engler A, Hadash A, Shehadeh N, Pillar G. Breastfeeding may improve nocturnal sleep and reduce infantile colic: potential role of breast milk melatonin. Eur J Pediatr 2012; 171: 729-732. https://doi.org/10.1007/s00431-011-1659-3

22. Scholtens PA, Goossens DA, Staiano A. Stool characteristics of infants receiving short-chain galacto-oligosaccharides and long-chain fructo-oligosaccharides: a review. World J Gastroenterol 2014; 20: 13446-13452. https://doi.org/10.3748/wjg.v20.i37.13446

23. İnce T, Akman H, Çimrin D, Aydın A. The role of melatonin and cortisol circadian rhythms in the pathogenesis of infantile colic. World J Pediatr 2018; 14: 392-398. https://doi.org/10.1007/s12519-018-0130-1

24. Woolridge MW, Fisher C. Colic, "overfeeding", and symptoms of lactose malabsorption in the breast-fed baby: a possible artifact of feed management? Lancet 1988; 2: 382-384. https://doi.org/10.1016/s0140-6736(88)92847-4

25. Camilleri M, Park SY, Scarpato E, Staiano A. Exploring hypotheses and rationale for causes of infantile colic. Neurogastroenterol Motil 2017; 29: 10.1111/nmo.12943. https://doi.org/10.1111/nmo.12943

26. Zhao W, Jin H, Xu M, et al. Sleep quality of functional gastrointestinal disorder patients in class-three hospitals: a cross-sectional study in Tianjin, China. Biomed Res Int 2018; 2018: 3619748. https://doi.org/10.1155/2018/3619748

27. Schurman JV, Friesen CA, Dai H, Danda CE, Hyman PE, Cocjin JT. Sleep problems and functional disability in children with functional gastrointestinal disorders: an examination of the potential mediating effects of physical and emotional symptoms. BMC Gastroenterol 2012; 12: 142. https://doi.org/10.1186/1471-230X-12-142

28. Orr WC, Fass R, Sundaram SS, Scheimann AO. The effect of sleep on gastrointestinal functioning in common digestive diseases. Lancet Gastroenterol Hepatol 2020; 5: 616-624. https://doi.org/10.1016/S2468-1253(19)30412-1

29. Hoogerwerf WA. Role of clock genes in gastrointestinal motility. Am J Physiol Gastrointest Liver Physiol 2010; 299: G549-G555. https://doi.org/10.1152/ajpgi.00147.2010

30. James-Roberts IS, Conroy S, Hurry J. Links between infant crying and sleep-waking at six weeks of age. Early Hum Dev 1997; 48: 143-152. https://doi.org/10.1016/s0378-3782(96)01845-2

31. Brand S, Furlano R, Sidler M, Schulz J, Holsboer-Trachsler E. 'Oh, baby, please don't cry!': in infants suffering from infantile colic hypothalamic-pituitary-adrenocortical axis activity is related to poor sleep and increased crying intensity. Neuropsychobiology 2011; 64: 15-23. https://doi.org/10.1159/000322456

32. Maxted AE, Dickstein S, Miller-Loncar C, et al. Infant colic and maternal depression. Infant Ment Health J 2005; 26: 56-68. https://doi.org/10.1002/imhj.20035

33. Beser OF, Cullu Cokugras F, Dogan G, et al. The frequency of and factors affecting functional gastrointestinal disorders in infants that presented to tertiary care hospitals. Eur J Pediatr 2021; 180: 2443-2452. https://doi.org/10.1007/s00431-021-04059-2