

Role of social media use in onset of functional gastrointestinal disorders in children

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The use of social media has increased considerably in recent years. However, these tools are not always used consciously, and the stress that can result from their inappropriate use is often underestimated. Children, who tend to be heavy users of social media, are exposed to risks associated with their intensive use. Data on the consequences of social media on children's health are extensive; however, few studies have examined the association between their use and functional gastrointestinal disorders (FGIDs). Our research showed that social media use is associated with adverse health outcomes such as stress, poor sleep quality, and gastrointestinal disorders in children and adolescents. FGIDs should be considered a group of biopsychosocial disorders involving gut dysfunction and psychological health. Stress may exacerbate the symptoms of these disorders and is associated with psychological comorbidities. Recent findings demonstrated a high prevalence of social media use and the incidence of psychological disorders, such as anxiety and depression, and decreased well-being in children with FGIDs. This review underlines that social media use is an emerging aspect of the psychosocial lives of children and adolescents; thus, it may be involved in FGID onset. Further studies in this field are needed to elucidate the link between social media and gastrointestinal health. Clinicians and politicians can play an important role in promoting the regulated and responsible use of digital platforms to protect the psychological health and preserve the well-being of children and adolescents.

Key words: Social media, Screen time, Gastrointestinal diseases, Child health

Key message

- Social media use can cause adverse health outcomes, including gastrointestinal disorders, in children and adolescents.
- Recent findings have shown a high prevalence of social media use and decreased well-being in patients with functional gastrointestinal disorders.

- The biopsychosocial nature of functional gastrointestinal disorders and the clear influence of social media on the psychosocial lives of children suggests the likely involvement of social media in their development.

Introduction

Social media has received considerable attention in recent years as the popularity of social networking communities continues to grow. Social networks, now an integral part of our daily lives, are the means of interactivity between people who create, share, and exchange information and ideas in virtual communities and networks.¹⁻⁴⁾ However, these tools are not always used deliberately, and some aspects are often underestimated, such as the stress that can result from their inappropriate use.⁵⁾

It is hypothesized that the use of social networks may affect various aspects of an individual's personality, such as their behavior and self-esteem,⁶⁾ in addition to their gut health and related body systems.⁷⁾ Data generated by research in this field are extensive and increasing annually, often showing inconsistencies and uneven results. Children, who are generally heavy users of social media, are particularly exposed to the risks associated with intensive social media use. An estimated 92% of youngsters living in economically advanced countries use social media, while 13- to 17-year-olds are consistently on social networks.⁸⁾

This article discusses the possible effects of social media use on children's health and well-being and their possible involvement in the onset of pediatric functional gastrointestinal disorders (FGIDs). This study aimed to raise clinician and parental awareness of the possible role of social networks in the onset of FGID in children and promote the responsible use of digital platforms by children and teenagers in the digital age.

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Children and adolescents' use of social media

With the widespread use of the Internet and commercialization of increasingly powerful smartphones, everyone has started using social networks and related applications (Table 1). More than 3.6 billion people worldwide used social networks in 2020, a number that is set to increase to nearly 4.41 billion in 3 years.⁹⁾ According to a report by O'Dea published in 2020,¹⁰⁾ the number of iPhone users in the United States exceeded 100 million, a number that increased to over 118 million in 2022. The current trend is toward increased virtual involvement of young people; globally, it is estimated that one in 3 children is currently an Internet user and that one in 3 Internet users is under 18 years old,¹¹⁾ with an average age of first Internet use decreasing to 8 years in Europe.^{1,12)}

It is clear that the Internet opens up new avenues for socialization, although online interactions often come at the expense of real-world personal contact. Social networks have radically changed the nature of interpersonal relationships and habits, our approach to information, and our choices within a very short period of time.

Globally, the primary social networks are Facebook, YouTube, WhatsApp, and Instagram. In 2021, 57.6% of the total global population used social media.⁹⁾ These platforms have become a primary mode of communication for many growing teenagers, as they provide a fast, cheap, and convenient method of communication. Social networks are convenient and accessible to anyone with few clicks. Distances have shortened, and it takes only seconds to connect with people worldwide. However, these tools are not always used deliberately, and some aspects are often underestimated that young people must be aware of to avoid unpleasant cognitive, social, psychological, and physical consequences.¹³⁾ When used inappropriately, social networks can become alienating and individuals can nearly lose touch with reality. Heavy Internet use is reportedly correlated with potential adverse effects, such as loss of control over Internet use and negative effects on other daily activities, emotional state, and communication between family members.^{2,7)} Several studies have highlighted the increase in cyberbullying,¹⁴⁾ privacy issues, and "sexting,"¹⁵⁾ probably due to children's limited ability to self-regulate their behavior and their susceptibility to peer pressure. In

Table 1. Use of social media in children

Study	Type of study	Sample	Aim	Outcomes
Kaess et al. ¹⁾ (2020)	Cross-sectional	11,356 (adolescents; mean age, 14.9 years)	Evaluation of the association between pathological Internet use and mental health disorders	Significant association between pathological Internet use and suicidal ideation or attempts, depression, anxiety, conduct problems, hyperactivity/inattention
Koyuncu et al. ²⁾ (2014)	Cross-sectional	1,157 (11–19 years; mean age, 15.13 years)	Evaluation of the prevalence of Internet addiction and loneliness	7.9% Prevalence of Internet addiction. Significant association between Internet addiction and loneliness, obesity, first time Internet usage before age 12, type A personality
Kawabe et al. ⁷⁾ (2016)	Cross-sectional	853 (12–15 years; mean age, 13.5 years)	Evaluation of the prevalence of Internet addiction and its relation between mental health	2% and 12% prevalence of Internet addiction and possible addiction. Significant association between Internet addiction and poor mental health
Woods and Scott ¹⁶⁾ (2016)	Cross-sectional	467 (11–17 years)	Evaluation of the association between social media use and sleep quality, self-esteem, anxiety, depression	Significant association between night-time social media use and poor sleep quality. Significant association between high social media use and anxiety, depression, lower self-esteem
Richards et al. ⁴⁰⁾ (2015)	Review		Overview of the impact of social media on the health of children and young adults	Significant impact of social media on self-esteem and well-being in children and young adults

Table 2. Psychosocial aspects of FGIDs

Study	Type of study and sample	Aim	Outcomes
Vandenplas et al. ²³⁾ (2019)	Review	Overview of the impact of FGIDs on individuals and society	Significant association between FGIDs and behavioral disorders. Assessment of the family environment and anxiety level has to be included in management of FGIDs.
Drossman ²¹⁾ (2016)	Review	Overview on pathophysiology and clinical features of FGIDs	Significant association between FGIDs and psychosocial factors such as psychological stress and stressing life events
Koloski et al. ¹⁸⁾ (2012)	Prospective randomized: 1,002 (adults)	Evaluation of the directionality of the brain-gut mechanism in FGIDs	High level of anxiety and depression are independent predictors of developing FGIDs
Varni et al. ³⁹⁾ (2015)	Cross-sectional comparative: 689 families of children with functional/organic GI disease vs. 522 families of healthy children (2–18 years; mean age, 11.43 years)	Evaluation of the clinical value of the Pediatric Quality of Life Inventory (PedsQL) in patients with functional or organic GI diseases	Significant association between higher scores in PedsQL (GI symptoms and worries) and subjects with a FGIDs compared with healthy subjects

FGIDs, functional gastrointestinal disorders; GI, gastrointestinal.

addition, lower sleep quality has been associated predominantly with night-time use of social media.¹⁶⁾ The role of bidirectional brain-gut interactions in triggering emotional responses and stress also deserves attention.^{17,18)} This phenomenon has been of particular interest to the medical community in recent years, and there is a growing body of evidence supporting the hypothesis that social media use can induce a range of adverse health outcomes in children and adolescents, including FGIDs, with implications for children’s well-being.¹³⁾

Psychosocial aspects of FGIDs

FGIDs include all the conditions that are caused by abnormal functioning of the gastrointestinal tract at the origin of which disease of a specific organ cannot be demonstrated.¹⁹⁾ They are characterized by chronic recurrent and age-specific symptoms and may be defined as “gut-brain interaction” disorders.²⁰⁾ The rationale lies in the localization in the digestive tract of the same receptors that regulate specific functions in the brain and whose alteration plays a decisive role in certain psychiatric disorders. The complexity and integration of this regulation of the gastrointestinal tract is such that the set of involved structures is called the “gut brain” (or “digestive brain”). However, the full details of this integration are unknown, even under physiological conditions (Table 2).

Some data suggest that these patients have visceral hypersensitivity, a nociceptive disorder in which they experience sensation-related discomfort (e.g., lumen distension and peristalsis) that other people do not perceive as painful. FGIDs are classified according to symptoms related to a combination of visceral hypersensitivity, motility, microbiota alteration, mucosal function, gut immunity, and central nervous system processing disorders.²¹⁾

FGIDs can affect any part of the digestive system (esophagus, stomach, small intestine, colon, biliary tract) and include approximately 20 conditions.²²⁾ They often have a long and variable course, are characterized by unpredictable symptoms, and have a severely debilitating effect on patient quality of life. FGIDs are common in children and represent an important social and medical burden,²³⁾ with an overall prevalence of 9.9%–29%, up to 87% in clinical samples,²⁴⁾ and a higher prevalence in female

subjects.²⁵⁾ Over time, the need for standardized diagnostic criteria for FGIDs has emerged, and 2 committees have been formed: one for infants and toddlers and one for children and adolescents. Based on these premises, an international committee of experts established a panel of criteria (Rome IV criteria)^{26,27)} by which FGIDs could be diagnosed based on clinical symptoms, limiting the use of investigations in the absence of inflammatory, metabolic, or anatomic abnormalities.²⁸⁾ However, despite the most recent findings on the pathophysiological mechanisms underlying FGIDs, no gold-standard diagnostic test is currently available.^{19,21)}

Considering the biopsychosocial model, it is evident that psychosocial stress can exacerbate gastrointestinal symptoms, alter disease experience and behavior, and subsequently cause chronic FGIDs that can affect an individual’s general well-being and psychosocial functioning.²⁹⁾ Common FGIDs include irritable bowel syndrome (IBS), the symptoms of which are often exacerbated by stress and may be associated with psychological comorbidities. The relationship between stress and gastrointestinal function is considered a direct consequence of the bidirectional modulation of gastrointestinal function by the central nervous system, including the modulation of motor responses and pain.³⁰⁾

FGIDs are generally not psychiatric disorders, although psychological stress can worsen them. Therefore, FGIDs should be considered a group of biopsychosocial disorders resulting from the interaction of multiple systems and factors, such as the nervous system, psychological factors, altered gut motility, and visceral hypersensitivity. Other causal factors include genetic factors, the influence of family behavior, and social media abuse and pressure.³¹⁾ In such circuits of interacting systems, events do not occur independently.³²⁾ Equally significant is the impact of FGIDs on quality of life, which is even worse than that of patients with organic diseases such as peptic ulcers or liver disease. The perception of symptoms may be modified by biological, psychological, and sociocultural factors, making them severe and disabling, severely impacting their activities of daily living.³³⁾

Children with functional abdominal pain reportedly have psychological comorbidities, such as anxiety, traumatic life events, stress, and depression.³⁴⁾ These factors alone or in combination can influence a child’s physiopsychological condition, possibly causing gut dysfunction³²⁾ through the brain-gut axis.^{13,36)} In

Table 3. Gut-brain axis and social media use

Study	Type of study	Sample	Aim	Outcomes
Samuel et al. ³⁵⁾ (2020)	Cross-sectional	59 (13–18 years; mean age, 15.8 years)	Evaluation of the association between social media use and the severity of GI symptoms in patients with IBS or functional abdominal pain	No significant association between screen time and, the number of social media used and severity of GI symptoms. Significant higher screen time in reading, entertainment and productivity activities in subjects with FGIDs
Cinquetti et al. ⁴²⁾ (2021)	Cross-sectional	1,594 (11–14 years; mean age, 12.87 years)	Evaluation of the prevalence of FGIDs in 11–14 years children and association with lifestyle and smartphone addiction	30,9% Prevalence of FGIDs. Significant association between FGIDs, smartphone addiction and low physical activity. Significant association between well-being and low smartphone use

GI, gastrointestinal; FGIDs, functional gastrointestinal disorders.

addition, psychosocial factors that may influence the development of FGIDs in children may include the use of social networks, a known cause of stress.³⁶⁾

Social media use and the gut-brain axis: is there a link?

In recent years, neuroscience has shown that the brain circuits involved in social media use are the same as those activated by social cognition (Table 3).³⁷⁾ Empirical data from the literature demonstrated beneficial effects of social media use on the mental health of children and adolescents.³⁸⁾ Through social media, young people can overcome the barriers of time and distance, stay in touch with their peers, organize their time, exchange ideas, strengthen their relationships, and maintain contact online.³⁸⁾ However, numerous studies have found a correlation between the intensive use of social networking sites and anxiety, depression, suicidal ideation, and self-harm in boys.¹⁾ A higher incidence of depression and anxiety in patients with FGID has been reported in the literature,^{35,39)} and an increased prevalence of social media use in these individuals has been observed and is likely correlated with symptom severity.^{36,40)} Therefore, several studies have examined the relationship between social media use and gastrointestinal symptom severity in patients diagnosed with functional abdominal pain or IBS.^{36,41)}

Cinquetti et al.⁴¹⁾ recently conducted a cross-sectional study of 1,594 students (mean age, 12.87 years) to study the association between smartphone use and FGID prevalence. According to Rome IV criteria, 30.9% of the children satisfied the criteria for FGID, and well-being was significantly lower in these children than in others (29.0% vs. 48.2%, $P<0.001$). Participants with a cell phone addiction had an increased prevalence of FGID (odds ratio, 1.98; 95% confidence interval, 1.47–2.68; $P<0.001$) and decreased well-being than others (18.0% vs. 25.8%, $P<0.001$). Therefore, the hypothesis of decreased well-being was confirmed in subjects diagnosed with FGID. This is another observation that motivates research to identify and eliminate multiple causes. Another parameter examined in this study was physical activity, which, when performed ≥ 3 times a week, was associated with a

reduced prevalence of FGID (27.3% vs. 34.1%, $P<0.001$).⁴²⁾ These results are in contrast with those of other studies presenting physical activity as a risk factor⁴³⁾; however, they are similar to those of other studies that reported physical activity as a protective factor.⁴⁴⁾ The authors speculated that children’s competitive activity may lead to stress instead of adequate performance, thereby contributing to FGID onset.

The collected data suggest the ease with which adolescents use certain technological devices. The familiarity with which they move between online and offline spaces is the result of habits and training that began at a young age at when they started using their home computers for school or play to when they became familiar with their parents’ cell phones and then received their own cell phones at 10 years of age.

In a cross-sectional study by Samuel et al.,³⁶⁾ 59 subjects aged 13–18 years, including 26 subjects with FGID and 33 healthy age-matched controls, completed a questionnaire about the time they spent on screens and the severity of their gastrointestinal symptoms. The average time spent on screens in the study group (341 min/day) was similar to that of the control group (331 min/day). The severity of abdominal pain and other gastrointestinal symptoms in adolescents with FGID was independent of the number of social media platforms used. However, in the subgroup analysis, the authors reported excessive use of screen time in the entertainment, reading, and productivity categories in the FGID group versus controls ($P<0.05$). Growing evidence indicates a correlation between excessive social media use, onset of psychological symptoms ($P<0.05$), and occurrence of psychological symptoms,^{35,45)} and many individuals with FGID often suffer from psychological problems. Therefore, anxiety and depression should be recognized as important risk factors for FGID.³³⁾

Recent research on effects of media devices on preschool children’s eating habits

The use of mobile media devices (MMDs) in young children is a growing phenomenon (Table 4).^{46,47)} However, to date, no studies have directly investigated the relationship between FGIDs

Table 4. Studies of use of media devices by preschool children

Study	Type of study	Sample	Aim	Outcomes
Kabali et al. ⁴⁷⁾ (2015)	Cross-sectional	350 (6 month–4 years)	Evaluation of infants' exposure to and use of mobile media devices	96.6% of subjects use mobile devices and time of first use is before age 1. At age 2, devices are used daily and screen time is high. At age 3–4, devices are used without help and media multitasking regards 1/3 of infants
Robinson et al. ⁴⁸⁾ (2022)	Cross-sectional	61 (3–5 years and 10–13 years)	Evaluation of the association between the number of media devices present at mealtime and the healthfulness of children's meals	Significant association between the number of media present at mealtime and low healthfulness of children's meals
Teekavanich et al. ⁴⁹⁾ (2022)	Cross-sectional	138 (18–30 months)	Evaluation of the association between regular media use, feeding difficulties and BMI	Significant association between regular media use, feeding difficulties (spitting or holding food in mouth, food refusal and disruptive behaviors) and a high BMI

BMI, body mass index.

and MMD use in preschool children.

FGIDs are associated with unbalanced eating habits, such as irregular meals, low fiber consumption, and high intake of unhealthy foods.⁴²⁾ Accordingly, some interesting studies have published the effects of media device use on preschool children.^{48,49)} Robinson et al.⁴⁸⁾ reported that the amount of media present during mealtime is inversely associated with the healthfulness of preschool children's meals. In fact, the presence of a greater number of devices was related to a low consumption of vegetables, fruits, grains, and healthy fats. Moreover, regular media use by toddlers is associated with eating-related disorders and a higher risk of obesity.⁴⁹⁾ Daily prolonged media use was significantly associated with feeding difficulties, including spitting or holding food in the mouth, food refusal, and disruptive mealtime behaviors.⁴⁹⁾ In contrast, regular media use during mealtime was reportedly associated with an increased body mass index.⁴⁹⁾

Given the role of eating habits in FGID development, social media use could be a risk factor for these disorders. Therefore, the latest evidence on the effects of social media on toddlers is worth greater attention by pediatricians and researchers.

Conclusion

Perspectives on the impact of social media on children have been widely reported in the literature; however, few investigations have examined the association between social media use and FGID. Social media use can be harmful in a variety of situations; however, it can also be beneficial during the developmental years by enhancing socialization skills and promoting information gathering and acquisition of new knowledge, thereby becoming the child's best learning tool.^{50,51)} However, it is important to regulate children's time spent on social media, limit its use, restrict its use to certain times of the day, or allow them to engage in it only after completing necessary tasks. Despite the inconsistencies in the research, the European Paediatric Association-Union of National Paediatric Societies and Associations warns that social media may play an important role in FGID development.⁵²⁾ Therefore, families and pediatricians have a teaching and training role in guiding adolescents and children in the appropriate use of social media from preschool age. Policies must also be used to regulate social media activity to protect children's psychological and emotional health from uncontrolled external influences and preserve their well-being.^{53,54)}

Footnotes

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References

1. Kaess M, Durkee T, Brunner R, Carli V, Parzer P, Wasserman C, et al. Pathological Internet use among European adolescents: psychopathology and self-destructive behaviours. *Eur Child Adolesc Psychiatry* 2014;23: 1093-102.
2. Koyuncu T, Unsal A, Arslantas D. Assessment of internet addiction and loneliness in secondary and high school students. *J Pak Med Assoc* 2014;6:998-1002.
3. Belle JM, Feld KA, Feld AD. Internet liability for gastroenterologists: select issues from social networking to doctor rating sites. *Clin Gastroenterol Hepatol* 2013;11:883-6.
4. Prasad B. Social media, health care, and social networking. *Gastrointest Endosc* 2013;77:492-5.
5. Ferrara P, Corsello G, Ianniello F, Sbordon A, Ehrich J, Giardino I, et al. Internet addiction: starting the debate on health and well-being of children overexposed to digital media. *J Pediatr* 2017;191:280-1.e1.
6. McCrae RR. Method biases in single-source personality assessments. *Psychol Assess* 2018;30:1160-73.
7. Kawabe K, Horiuchi F, Ochi M, Oka Y, Ueno S. Internet addiction: prevalence and relation with mental states in adolescents. *Psychiatry Clin Neurosci* 2016;70:405-12.
8. Lenhart A. *Teens, social media and technology*. Washington, DC: Pew Research Centre, 2015.
9. Statista. Number of social media users worldwide from 2017 to 2027 [Internet]. New York (NY): Statista, 2020 [cited 2022 Jun 1]. Available from: <https://www.statista.com/statistics/278414/number-of-worldwide-social-network-users/>.
10. O'Dea S. Share of smartphone users that use an Apple iPhone in the United States from 2014 to 2022 [Internet]. New York (NY): Statista; 2020 [cited 2022 Jun 1]. Available from: <https://www.statista.com/statistics/236550/percentage-of-us-population-that-own-a-iphone-smartphone/>.
11. Lim C. Growing up in a connected world. In: *Her Story* 2005;24-27.
12. Child Trends database. Home computer access and Internet use: indicators of child and adolescent well-being [Internet]. National Center on Safe Supportive Learning Environments; 2023 [cited 2022 Jun 1]. Available from: <https://safesupportivelearning.ed.gov/resources/child-trends-databank>.
13. Ide S, Yamamoto R, Takeda H, Minami M. Bidirectional brain-gut interactions: Involvement of noradrenergic transmission in the ventral part of the bed nucleus of the terminal stria. *Neuropsychopharmacol Rep*

2018;38:37-43.

14. Patchin JW, Hinduja S. Bullies move beyond the schoolyard: a preliminary look at cyberbullying. *Youth Violence Juv Justice* 2006;4:148-69.
15. A thin line: 2009 AP-TVT digital abuse study [internet]. A THIN LINE; 2022 [cited 2022 Jun 1]. Available from: www.athinline.org/MTV-AP_Digital_Abuse_Study_Executive_Summary.pdf.
16. Woods HC, Scott H. #Sleepyteens: social media use in adolescence is associated with poor sleep quality, anxiety, depression and low self-esteem. *J Adolesc* 2016;51:41-9.
17. Haag S, Senf W, Tagay S, Heuft G, Gerken G, Talley NJ, et al. Is there any association between disturbed gastrointestinal visceromotor and sensory function and impaired quality of life in functional dyspepsia? *Neurogastroenterol Motil* 2010;22:262-e79.
18. Koloski NA, Jones M, Kalantar J, Weltman M, Zaguirre J, Talley NJ. The brain-gut pathway in functional gastrointestinal disorders is bidirectional: a 12-year prospective population-based study. *Gut* 2012;61:1284-90.
19. Fikree A, Byrne P. Management of functional gastrointestinal disorders. *Clin Med (Lond)* 2021;21:44-52.
20. Settembre C, D'Antonio E, Moscato P, Loi G, Santonicola A, Iovino P. Association among disorders of gut-brain interaction (DGBI) and fibromyalgia: A prospective study. *J Clin Med* 2022;11:809.
21. Drossman DA. Functional gastrointestinal disorders: history, pathophysiology, clinical features and Rome IV. *Gastroenterology* 2016 Feb 19; S0016-5085(16)00223-7. doi: 10.1053/j.gastro.2016.02.032. [Epub]
22. Mahon J, Lifschitz C, Ludwig T, Thapar N, Glanville J, Miqdady M, et al. The costs of functional gastrointestinal disorders and related signs and symptoms in infants: a systematic literature review and cost calculation for England. *BMJ Open* 2017;7:e015594.
23. Vandenplas Y, Hauser B, Salvatore S. Functional gastrointestinal disorders in infancy: impact on the health of the infant and family. *Pediatr Gastroenterol Hepatol Nutr* 2019;22:207-16.
24. Boronat AC, Ferreira-Maia AP, Matijasevich A, Wang YP. Epidemiology of functional gastrointestinal disorders in children and adolescents: a systematic review. *World J Gastroenterol* 2017;23:3915-27.
25. Peralta-Palmezano JJ, Guerrero-Lozano R. Prevalence of functional gastrointestinal disorders in school children and adolescents. *Korean J Gastroenterol* 2019;73:207-12.
26. Benninga MA, Faure C, Hyman PE, St James Roberts I, Schechter NL, Nurko S. Childhood functional gastrointestinal disorders: neonate/toddler. *Gastroenterology* 2016 Feb 15;S0016-5085(16)00182-7. doi: 10.1053/j.gastro.2016.02.016. [Epub]
27. Rasquin A, Di Lorenzo C, Forbes D, Guiraldes E, Hyams JS, Staiano A, et al. Childhood functional gastrointestinal disorders: child/adolescent. *Gastroenterology* 2006;130:1527-37.
28. Drossman DA, Hasler WL. Rome IV-functional GI disorders: disorders of gut-brain interaction. *Gastroenterology* 2016;150:1257-61.
29. Indrio F, Mestrovic J, Carrasco-Sanz A, Vural M, Namazova-Baranova L, Giardino I, et al. Overview on child health, nutrition and food hazards during the first thousand days of life. *Glob Pediatr* 2022;2:100018.
30. Rantsiou K, Tsourekis D, Botta C, Ratel J, Engel E, Coccolin L. Implementation of omics tools for infant food microbial safety. *Glob Pediatr* 2022;2:100011.
31. Knowles SR, Stern J, Hebbard G. Functional gastrointestinal disorders. A biopsychosocial approach. Oxfordshire (UK): Routledge, 2019.
32. Porcelli P, Todarello O. Psychological factors affecting functional gastrointestinal disorders. *Adv Psychosom Med* 2007;28:34-56.
33. Jones MP, Crowell MD, Olden KW, Creed F. Functional gastrointestinal disorders: an update for the psychiatrist. *Psychosomatics* 2007;48:93-102.
34. Primack BA, Shensa A, Escobar-Viera CG, Barrett EL, Sidani JE, Colditz JB, et al. Use of multiple social media platforms and symptoms of depression and anxiety: a nationally-representative study among U.S. young adults. *Comput Hum Behav* 2017;69:1-9.
35. Drukker M, Peters JCH, Vork L, Mujagic Z, Rutten BPF, van Os J, et al. Network approach of mood and functional gastrointestinal symptoms. Mood dynamics and functional gastrointestinal symptoms in relation to childhood trauma in patients with irritable bowel syndrome and comorbidities of irritable bowel syndrome and panic disorder in comorbidity. *J Psychosom Res* 2020;139:110261.
36. Samuel E, Lahiri S, Hashmi S, Navarro F. Social media use in adolescents with functional abdominal pain. *Front Pediatr* 2020;8:592972.
37. Meshi D, Tamir DI, Heekeren HR. The emerging neuroscience of social media. *Trends Cogn Sci* 2015;19:771-82.
38. Bekalu MA, McCloud RF, Viswanath K. Association of social media use with social well-being, positive mental health, and self-rated health: disentangling routine use from emotional connection to use. *Health Educ Behav* 2019;46(2_suppl):69-80.
39. Varni J, Bendo C, Shulman R, Self M, Nurko S, Franciosi J, et al. Interpretability of the PedsQL gastrointestinal symptom scales and gastrointestinal concern scales in pediatric patients with functional and organic gastrointestinal diseases. *J Pediatr Psychol* 2015;40:591-601.
40. Richards D, Caldwell P, Go H. Impact of social media on the health of children and youth. *J Paediatr Child Health* 2015;51:1152-7.
41. Cinquetti M, Biasin M, Ventimiglia M, Balanzoni L, Signorelli D, Pietrobello A. Functional gastrointestinal disorders and smartphone use in adolescents. *Clin Exp Pediatr* 2021;64:494-6.
42. Cinquetti M, Biasin M, Ventimiglia M, Balanzoni L, Signorelli D, Pietrobello A. Functional gastrointestinal disorders, lifestyle habits, and smartphone addiction in adolescents. *Pediatr Med Chir* 2021;43(1). doi: 10.4081/pmc.2021.238.
43. Strid H, Simrén M, Störsrud S, Stotzer PO, Sadik R. Effect of heavy exercise on gastrointestinal transit in endurance athletes. *Scand J Gastroenterol* 2011;46:673-7.
44. Ohlsson B, Manjer J. Physical inactivity during leisure time and irregular meals are associated with functional gastrointestinal complaints in middle-aged and elderly subjects. *Scand J Gastroenterol* 2016;51:1299-307.
45. Wright KB, Rosenberg J, Egbert N, Ploeger NA, Bernard DR, King S. Communication competence, social support, and depression among college students: a model of facebook and face-to-face support network influence. *J Health Commun* 2013;18:41-57.
46. Rideout V, Saphir M, Pai S, Rudd A. Zero to eight: children's media use in America 2013. Common Sense Media. 2013. New York (NY): Common Sense Media; [cited 2022 Jun 1]. Available from: <https://www.common Sense Media.org/zero-to-eight-2013-infographic>.
47. Kabali HK, Irigoyen MM, Nunez-Davis R, Budacki JG, Mohanty SH, Leister KP, et al. Exposure and use of mobile media devices by young children. *Pediatrics* 2015;136:1044-50.
48. Robinson CA, Domoff SE, Kasper N, Peterson KE, Miller AL. The healthfulness of children's meals when multiple media and devices are present. *Appetite* 2022;169:105800.
49. Teekavanich S, Rukprayoon H, Sutchitpong S, Rojmahamongkol P. Electronic media use and food intake in Thai toddlers. *Appetite* 2022; 176:106121.
50. Joseph J, Varghese A, Vr V, Dhandapani M, Grover S, Sharma S, et al. Prevalence of internet addiction among college students in the Indian setting: a systematic review and meta-analysis. *Gen Psychiatr* 2021;34: e100496.
51. Sugata M, Vivek R. Children and the internet: experiments with minimally invasive education in India. *Br J Educ Technol* 2001;32:221-32.
52. Cinquetti M, Dargenio V, Giardino I, Pettoello-Mantovani M, Indrio F. Social media and functional gastrointestinal disorders in children. *J Pediatr* 2022;247:182-83.e3.
53. Pettoello-Mantovani M, Namazova-Baranova L, Ehrlich J. Integrating and rationalizing public healthcare services as a source of cost containment in times of economic crises. *Ital J Pediatr* 2016;42:18.
54. Somekh I, Somekh R, Pettoello-Mantovani M, Somekh E. Changes in routine pediatric practice in light of coronavirus 2019 (COVID-19). *J Pediatr* 2020;224:190-3.

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