DOI: https://doi.org/10.22516/25007440.494

Case report

Findings of upper gastrointestinal endoscopy in children with short stature

Julio César Castro-Murillo,[1] Carlos Alberto Velasco-Benítez,[2*] Otto Gerardo Calderón-Guerrero.[3]

OPEN ACCESS

Citation:
Castro-Murillo JC, Velasco-Benítez CA, Calderón-Guerrero OG. Findings of upper gastrointestinal endoscopy in children with short stature. Rev Colomb Gastroenterol. 2021;36(1):130-137. https://doi.org/10.22516/25007440.494

[1] MD. Pediatric Residency student. Universidad del Valle. Hospital Universitario del Valle "Evaristo García". Cali, Colombia
[2] Pediatrician. Gastroenterologist and Nutritionist. Distinguished Professor, Universidad del Valle. Hospital Universitario del Valle "Evaristo García". Cali, Colombia.
[3] Pediatrician. Gastroenterologist. Professor, Pontificia Universidad Javeriana. Clínica Materno Infantil Los Farallones. Cali, Colombia.

***Correspondence:** Carlos A Velasco-Benítez.
carlos.velasco@correounivalle.edu.co

Received: 29/12/19
Accepted: 19/03/20

Abstract

Introduction: The study of short stature of digestive origin in children shows no pre-established laboratory patterns. However, endoscopy of the digestive tract may be a useful tool for this purpose. **Objective:** To report a series of cases of children with a diagnosis of short stature who underwent upper digestive tract endoscopy as part of their study. **Case report:** 15 children between the ages of 2 and 16 years were included; 53.3 % were girls. 26.7 % presented with malnutrition according to their body mass index and height-for-age, 66.7 % had short stature, and 33.3 % moderate short stature. Abdominal pain was reported in 53.3 % of the cases, and no weight gain in 46.7 %. Other symptoms were lack of appetite in 26.7 %, vomiting in 13.3 %, among others. Between 40 % and 93.4 % of the children presented macro and/or microscopic esophagitis, gastritis, and duodenitis. The most important microscopic findings were chronic duodenitis with giardiasis, duodenal ulcers, duodenal nodular lymphoid hyperplasia, *Helicobacter pylori*, and chronic eosinophilic duodenitis. **Conclusions:** Although endoscopy of the digestive tract is a method barely used and not well described in the study of children with short stature, this case report describes organicity in 80 % of the children analyzed.

Keywords

Growth failure, Children, Endoscopy.

INTRODUCTION

Short stature in children is determined after performing a nutritional assessment and observing that they do not gain height according to their growth and development stage (1). Short stature is a frequent condition and occurs when caloric intake is insufficient to maintain growth (2). It has multiple causes and they can be psychosocial, organic and non-organic, being the latter found in only a few cases, and its main warning sign is the difficulty to have or maintain an ideal healthy weight (2).

In most cases, short stature is reversible by means of nutritional intervention; otherwise, its persistence can turn it into an underlying organic disease that requires performing laboratory, imaging and other tests, such as upper gastrointestinal endoscopy (also known as esophagogastroduodenoscopy - EGD), to determine its etiology (2). From the digestive point of view, short stature can be secondary to gastroesophageal reflux disease, celiac disease and other chronic disorders (3, 4).

The World Health Organization (WHO) classification (5), which includes children with > - 2 standard devia-

tions (SD) of height-for-age (HA), was considered in this case series report. Provided that in this definition weight/height and body mass index (BMI) can be normal, short stature may be related to long-term chronic processes and organic diseases.

There is no a standard regarding the specific complementary tests that should be performed in these cases; however, paraclinical testing by a multidisciplinary team is fundamental in the initial management of children with short stature, and EGD is a useful tool to rule out digestive etiologies as it allows the macro- and microscopic identification of an organic alteration as the cause of short stature (2, 3, 6).

The objective of this paper is to report a series of cases of children aged between 2 and 16 years with a diagnosis of short stature according to the WHO definition, and who underwent an upper gastrointestinal endoscopy in a pediatric endoscopy unit (PEU) in Cali, Colombia, as part of their assessment studies.

CASES REPORT

General characteristics

A total of 15 children aged 7.1 ± 4.9 years (range = 2-16 years) were included: 46.7 % were preschoolers (2-5 years), 40.0 %, schoolchildren (6-12 years), and 13.3 %, adolescents (13-16 years); 53.3 % were female and attended a PEU in Cali, Colombia. The following mean ± SD and range values were found: weight = 16.4 ± 9.3 kg (range = 7.8-39.9 kg), height = 100.6 ± 24.6 cm (range = 74-148 cm), BMI according to the WHO = -0.8 ± 1.2 SD (range = -3.1 and +1.4 SD) and HA = -3.9 ± 1.3 SD (range = -6.4 and -2.0 SD); According to the WHO definition of BMI, 26.7% of the children were undernourished, and severe and moderate short stature was observed in 66.7% and 33.3% of the cases, respectively, according to the HA definition of the WHO.

Symptomatology

Symptoms such as abdominal pain, absence of weight gain, lack of appetite, vomiting, and diarrhea and abdominal distension were reported in 53.3 %, 46.7 %, 26.7 %, 13.3 %, 6.7 % and 6.7% of the cases, respectively (**Table 1**).

Macro- and microscopic findings

The most frequent findings reported in the EGDs and the biopsy reports were esophagitis, gastritis and duodenitis, ranging from 40.0 % and 93.4 % (**Table 2**).

Other important findings such as chronic duodenitis with giardiasis (**Figure 1**), duodenal ulcers (**Figure 2**), duodenal nodular lymphoid hyperplasia, *Helicobacter pylori*, and chronic eosinophilic duodenitis were also identified (**Table 3**).

Giardiasis, *H. pylori* and short stature

In order to analyze the association between the presence of *Giardia lamblia* and *H. pylori* and short stature (**Tables 4** and **5**) we searched for original articles published between January 1, 2000 and October 31, 2019 in the PubMed database using the following search terms in Spanish, English and Portuguese, respectively: "malnutrición" and "niños"; "malnutrition" and "children"; and "desnutrição" and "criancas". Only original articles reporting research results were considered. Prevalence of giardiasis, short stature and the possible association between giardiasis and short stature were mainly considered. Duplicate publications, as defined by having similar authors, sample sizes, and country, were not included.

Table 1. Symptomatology dependent on microscopic findings in 15 children with low stature from a pediatric endoscopy unit in Cali, Colombia

	Esophagus (n, %)		*p*	Stomach (n, %)		*p*	Duodenum (n, %)		*p*
	Normal	Inflamed		Normal	Inflamed		Normal	Inflamed	
Abdominal pain	4 (26.7)	4 (26.7)	0.659	4 (26.7)	4 (26.7)	0.659	4 (26.7)	4 (26.7)	0.659
Absence of weight gain	1 (6.7)	6 (40.0)	0.040	5 (33.3)	2 (13.3)	0.195	3 (20.0)	4 (26.7)	0.599
Lack of appetite	0 (0.0)	4 (26.7)	0.050	2 (13.3)	2 (13.3)	0.701	1 (6.7)	3 (20.0)	0.299
Vomiting	0 (0.0)	2 (13.3)	0.241	1 (6.7)	1 (6.7)	0.759	1 (6.7)	1 (6.7)	0.759
Diarrhea	1 (6.7)	0 (0.0)	0.500	0 (0.0)	1 (6.7)	0.500	1 (6.7)	0 (0.0)	0.500
Abdominal distension	1 (6.7)	0 (0.0)	0.500	0 (0.0)	1 (6.7)	0.500	1 (6.7)	0 (0.0)	0.500

Table 2. Macro- and microscopic findings in 15 children with short stature from a pediatric endoscopy unit in Cali, Colombia

Findings	Macroscopic	Microscopic	*p*
	n (%)	n (%)	
Esophagitis	14 (93.4)	11 (73.4)	0.165
Gastritis	13 (86.7)	7 (46.7)	0.025
Duodenitis	12 (80.0)	6 (40.0)	0.030
Esophagitis, gastritis, duodenitis	9 (60.0)	3 (20.0)	0.030

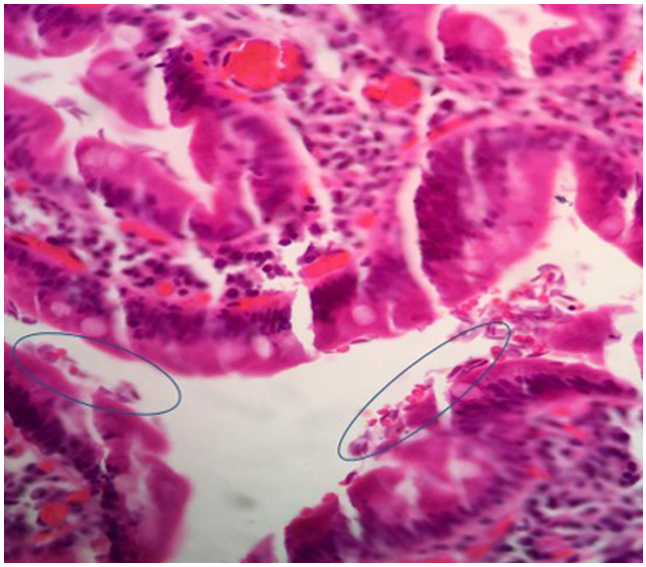

Figure 1. A 2-year-old girl with chronic duodenitis and giardiasis. Courtesy of Ramiro Pineda. Clínica Materno Infantil Los Farallones. Cali, Colombia.

DISCUSSION

Although the use of EGD is indicated for the study of children with short stature (6), it remains a poorly used method for this purpose and it has not been well described in the literature, as reported by Larson et al. (28), who found that this procedure is more useful in children with short stature than imaging or paraclinical tests and reported the presence of organic etiologies in 16.7 % of the children; however, in said study upper GI endoscopy was only indicated in 10 % of these patients.

In our study, 12 out of 15 children (80.0 %) had at least one esophageal, stomach or duodenal alteration, which differs from the findings reported in the study by Larson et al. (28), where non-organic etiologies for failure to thrive were determined for most of the children referred to a tertiary care pediatric gastroenterology clinic due to having short stature,

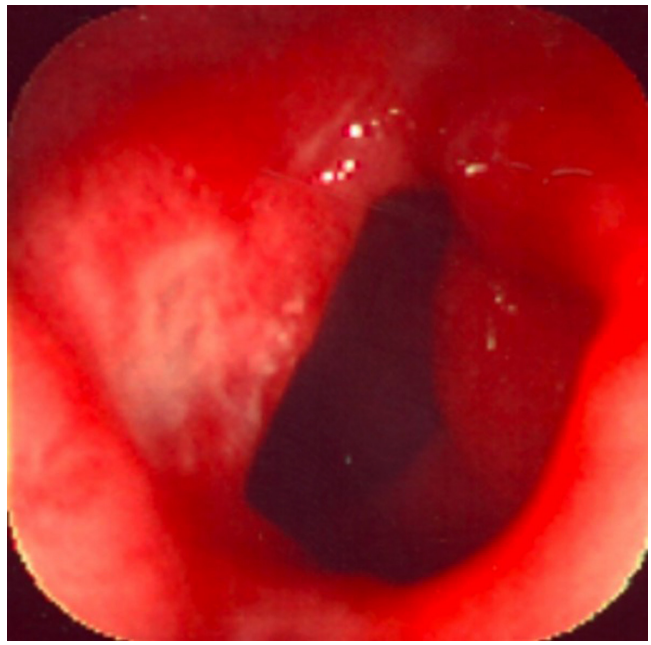

Figure 2. A 3-year-old girl with duodenal ulcers.

despite the fact that in 66.3% of these children a diagnostic test was required to evaluate short stature. Additionally, in our study, 40.0 % of the patients had duodenitis according to the histopathology report, which is a similar figure to that described by El Mouzan et al. (29), who, in a study conducted in 116 children with short stature and in which a duodenal biopsy was performed, reported abnormal findings in 44.0 % (n=65): villous atrophy in half of them and unspecific chronic duodenitis in the other half.

Two of our patients presented with severe short stature, along with chronic duodenitis and giardiasis. Studies are controversial regarding the possible association between giardiasis and short stature (**Table 4**) (7, 20). *Giardia lamblia* causes a decreased intake of the nutrients required by the body due to its interrelation with intestinal absorption surfaces and nutrient consumption by the organism, as a consequence of physical obstruction in the intestinal lumen and the production of proteolytic substances, among others (30). Parasitic infections are believed to contribute to malnutrition through the subtle reduction of digestion and nutrient absorption, chronic inflammation and nutrient loss (31). Giardia is known to cause acute diarrhea, as well as fats, vitamins and D-xylose malabsorption, and lactose intolerance, especially in children (32). In addition, it has been well documented that Giardia trophozoites disrupt the normal villous architecture by causing a shortening of the villi and the inflammation of the foci in the crypts and lamina propria, resulting in malabsorption (31). All these

Table 3. Clinical-pathological correlation in 15 children with short stature from a pediatric endoscopy unit in Cali, Colombia

Sex	Age (years)	Nutritional diagnosis	Symptoms	Microscopic findings
Female	2	Severe short stature	Lack of appetite	Chronic duodenitis Giardiasis
Female	2	Severe short stature	Lack of appetite Absence of weight gain	Chronic duodenitis Giardiasis
Male	3	Moderate short stature	Vomiting	Acute prepyloric ulcer
Female	2	Severe short stature	Abdominal pain	*H. pylori* Duodenal nodular lymphoid hyperplasia
Female	2	Moderate short stature	Absence weight gain	Duodenal nodular lymphoid hyperplasia
Male	16	Severe short stature	Absence weight gain	Chronic eosinophilic duodenitis

Table 4. Giardiasis and short stature

Author	Year	Country	n	Age (years)	G. lamblia (%)	Growth failure (%)	Association
Ihejirika (7)	2019	Nigeria	300	5-13	2.7	26.0	No
Lehto (8)	2019	Malawi	840	0-2	5.1-10.6	z-score -0.12	Yes
Rivero (9)	2018	Argentina	303	0-15	33.3	38.9	Yes
Yentur (10)	2015	Turkey	100	0-6	42.5	16.0	Yes
Heimer (11)	2015	Rwanda	622	6-18	28.0-43.9	z-score -1.8 y -0.6	Yes
Centeno-Lima (12)	2013	Guinea-Bissau	109	0-5	29.0	28.4	No
Al-Mekhlafi (13)	2013	Malaysia	374	7-12	22.2	24.8	No
Verhagen (14)	2013	Venezuela	390	4-16	20.0	13-84	Yes
Zonta (15)	2010	Argentina	178	1-14	20.0	44.9	Yes
Maia (16)	2009	Brazil	451	0-10	21.5	17.5	No
Silva (17)	2009	Brazil	405	0-6	26.3	7.9	No
Nematian (18)	2008	Iran	19 209	8.5 ± 1.5	11.5	2.8-3.8	Yes
Muniz-Junqueira (19)	2002	Brazil	124	1-6	30.4	16.0	Yes
Berkman (20)	2002	Peru	239	0-2	14.1	42.0	Yes

mechanisms contribute to the development of malnutrition in individuals infected with *Giardia lambia* (33).

The results of studies evaluating the effect of *H. pylori* infection on children's growth differ a lot, as some report the presence of this association, while others, its absence (**Table 5**) (21, 27). The mechanism through *which H. pylori* causes failure to thrive has not yet been researched, since it is not clear whether the inflammation induced by *H. pylori* directly affects child growth, or if the latter is a consequence of *H. pylory infection* indirect effects such as infection-induced anorexia, changes in intestinal permeability, malabsorption or diarrheal disease (34). Currently, environmental enteric dysfunction (DEA), generalized altered structure and function of the small intestine, subclinical state of intestinal inflammation, bowel incontinence, increased permeability, dysbiosis, bacterial translocation,

Table 5. *H. pylori* and short stature

Author	Year	Country	n	Age (years)	*H. pylori* (%)	Growth failure	Association
Chiu (21)	2017	Taiwan	53	4-18	29.2	32.0 %	No
Kocaoglu (22)	2016	Turkey	200	7-18	59.5	*0.49 ± 3.85	Yes
Soylu (23)	2008	Turkey	108	6.9-17.3	52.8	12.3%	No
Fialho (24)	2007	Brazil	353	0.6-14	55.8	**6.62 (IC 95 % 1.71-25.55. p = 0.006)	Yes
Süoglu (25)	2007	Turkey	70	4-16	50.0	***−0.768 ± 1.252	Yes
Chimonas (26)	2006	United States	650	7-11	87.1	39.0 % ± 26.4 %	No
Richter (27)	2001	Germany	3315	5-7	6.2	***−0.253 ± 1.088	Yes

*Growth velocity. **Odds ratio (OR). ***Mean ± SD. CI: Confidence interval.

systemic inflammation and nutrient malabsorption (35) resulting from chronic pathogen exposure, which in turns involves healing and growth delay (36) cannot be ruled out as possible causes of short stature in children. Although pathogenesis between these two conditions is not yet fully defined, nutritional recommendations based on WASH (water, sanitation and hygiene) interventions are proposed (36). Some of these interventions include reducing exposure to stools and animal contact through programs such as improved water, sanitation and hygiene access; breastfeeding and improved dietary diversity; probiotics and prebiotics; nutritional supplements, including zinc, polyunsaturated fatty acids and amino acids; anti-inflammatory agents such as 5-aminosalicyclic acid; and antibiotics in acute malnutrition and infection cases (35).

In addition, "omics" technologies (genomics, epigenomics, transcriptomics, proteomics, and metabolomics) and stable isotope techniques (e.g. Carbon-13 breath tests) aimed at evaluating gut microbiota in children are thought to improve the ability to successfully identify, manage, and prevent this disorder in the future (35).

In the present study, eosinophilic duodenitis was found in 1 patient, being inability to gain weight the main symptom, a finding that has also being described by other authors (37, 38); likewise, it seems these patients respond adequately to montelukast therapy (39). Other digestive symptoms in children with eosinophilic duodenitis are abdominal pain and diarrhea (37, 38). In addition, in these patients, histopathological changes in the duodenum include micro erosion and fibrosis (40), however in these children, biomarkers are not diagnostic tests usually considered (41).

In our study, only one child presented with prepyloric ulcer. The occurrence of peptic ulcer disease in children is rare: between 0.6 % and 12.8 % gastric or duodenal ulcers cases are reported in this population (42, 43); however, its morbidity may include severe complications such as perforation, bleeding, stricture and intestinal obstruction. Weight-for-length/height growth alterations in children with acid peptic disease is associated, to a greater or lesser extent, with the presence of symptoms, which in early ages can be irritable bowel syndrome, poor feeding, regurgitation, vomiting or digestive bleeding; and in older children, abdominal pain, flatulence, abdominal distension, nausea, and sleep disorders, among others (44).

In addition, duodenal nodular lymphoid hyperplasia was observed in two patients, one of them with gastric *H. pylori* infection, an association that was reported by Blanco et al. (45). Although the amount of lymphoid tissue found in the mucosa of the digestive tract can be greater in children than in adults, the presence of duodenal nodular lymphoid hyperplasia is a rare endoscopic finding with an uncertain clinical significance, and unclear clinical anthropometric repercussions. Lymphoid hyperplasia has been described in children with food allergy, hypogammaglobulinemia (46), *G. lamblia* infestation (47), and in patients with end-stage renal failure and with peptic disease secondary to *H. pylori* infection (45).

In conclusion, despite that upper GI endoscopy is a method poorly used in children with short stature, and its usefulness in this population has not been well described, in this case series an organic etiology was determined for short stature in 80.0 % of children who underwent this procedure.

REFERENCES

1. Becker P, Carney LN, Corkins MR, Monczka J, Smith E, Smith SE, Spear BA, White JV; Academy of Nutrition and Dietetics; American Society for Parenteral and Enteral Nutrition. Consensus statement of the Academy of Nutrition and Dietetics/American Society for Parenteral and Enteral Nutrition: indicators recommended for the identification and documentation of pediatric malnutrition (undernutrition). Nutr Clin Pract. 2015;30(1):147-61. https://doi.org/10.1177/0884533614557642
2. Larson-Nath C, Biank VF. Clinical Review of Failure to Thrive in Pediatric Patients. Pediatr Ann. 2016;45(2):e46-9. https://doi.org/10.3928/00904481-20160114-01
3. Homan GJ. Failure to Thrive: A Practical Guide. Am Fam Physician. 2016;94(4):295-9.
4. Bouma S. Diagnosing Pediatric Malnutrition. Nutr Clin Pract. 2017;32(1):52-67. https://doi.org/10.1177/0884533616671861
5. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007;85(9):660-7. https://doi.org/10.2471/blt.07.043497
6. Thomson M, Tringali A, Dumonceau JM, Tavares M, Tabbers MM, Furlano R, Spaander M, Hassan C, Tzvinikos C, Ijsselstijn H, Viala J, Dall'Oglio L, Benninga M, Orel R, Vandenplas Y, Keil R, Romano C, Brownstone E, Hlava Š, Gerner P, Dolak W, Landi R, Huber WD, Everett S, Vecsei A, Aabakken L, Amil-Dias J, Zambelli A. Paediatric Gastrointestinal Endoscopy: European Society for Paediatric Gastroenterology Hepatology and Nutrition and European Society of Gastrointestinal Endoscopy Guidelines. J Pediatr Gastroenterol Nutr. 2017;64(1):133-153. https://doi.org/10.1097/MPG.0000000000001408
7. Ihejirika OC, Nwaorgu OC, Ebirim CI, Nwokeji CM. Effects of intestinal parasitic infections on nutritional status of primary children in Imo State Nigeria. Pan Afr Med J. 2019;33:34. https://doi.org/10.11604/pamj.2019.33.34.17099
8. Lehto KM, Fan YM, Oikarinen S, Nurminen N, Hallamaa L, Juuti R, Mangani C, Maleta K, Hyöty H, Ashorn P. Presence of Giardia lamblia in stools of six- to 18-month old asymptomatic Malawians is associated with children's growth failure. Acta Paediatr. 2019;108(10):1833-1840. https://doi.org/10.1111/apa.14832
9. Rivero MR, De Angelo C, Nuñez P, Salas M, Liang S. Intestinal parasitism and nutritional status among indigenous children from the Argentinian Atlantic Forest: Determinants of enteroparasites infections in minority populations. Acta Trop. 2018;187:248-256. https://doi.org/10.1016/j.actatropica.2018.08.015
10. Yentur Doni N, Yildiz Zeyrek F, Simsek Z, Gurses G, Sahin İ. Risk Factors and Relationship Between Intestinal Parasites and the Growth Retardation and Psychomotor Development Delays of Children in Şanlıurfa, Turkey. Turkiye Parazitol Derg. 2015;39(4):270-6. https://doi.org/10.5152/tpd.2015.3620
11. Heimer J, Staudacher O, Steiner F, Kayonga Y, Havugimana JM, Musemakweri A, Harms G, Gahutu JB, Mockenhaupt FP. Age-dependent decline and association with stunting of Giardia duodenalis infection among schoolchildren in rural Huye district, Rwanda. Acta Trop. 2015;145:17-22. https://doi.org/10.1016/j.actatropica.2015.01.011
12. Centeno-Lima S, Rosado-Marques V, Ferreira F, Rodrigues R, Indeque B, Camará I, De Sousa B, Aguiar P, Nunes B, Ferrinho P. Giardia Duodenalis e Desnutrição Crónica em Crianças Menores de Cinco Anos de uma Região Rural da Guiné-Bissau. Acta Med Port. 2013;26(6):721-4.
13. Al-Mekhlafi HM, Al-Maktari MT, Jani R, Ahmed A, Anuar TS, Moktar N, Mahdy MA, Lim YA, Mahmud R, Surin J. Burden of Giardia duodenalis infection and its adverse effects on growth of schoolchildren in rural Malaysia. PLoS Negl Trop Dis. 2013;7(10):e2516. https://doi.org/10.1371/journal.pntd.0002516
14. Verhagen LM, Incani RN, Franco CR, Ugarte A, Cadenas Y, Sierra Ruiz CI, Hermans PW, Hoek D, Campos Ponce M, de Waard JH, Pinelli E. High malnutrition rate in Venezuelan Yanomami compared to Warao Amerindians and Creoles: significant associations with intestinal parasites and anemia. PLoS One. 2013;8(10):e77581. https://doi.org/10.1371/journal.pone.0077581
15. Zonta ML, Oyhenart EE, Navone GT. Nutritional status, body composition, and intestinal parasitism among the Mbyá-Guaraní communities of Misiones, Argentina. Am J Hum Biol. 2010;22(2):193-200. https://doi.org/10.1002/ajhb.20977
16. Maia MM, Fausto MA, Vieira EL, Benetton ML, Carneiro M. Intestinal parasitic infection and associated risk factors, among children presenting at outpatient clinics in Manaus, Amazonas state, Brazil. Ann Trop Med Parasitol. 2009;103(7):583-91. https://doi.org/10.1179/000349809X12459740922417
17. Silva RR, da Silva CA, de Jesus Pereira CA, de Carvalho Nicolato RL, Negrão-Corrêa D, Lamounier JA, Carneiro M. Association between nutritional status, environmental and socio-economic factors and Giardia lamblia infections among children aged 6-71 months in Brazil. Trans R Soc Trop Med Hyg. 2009;103(5):512-9. https://doi.org/10.1016/j.trstmh.2008.10.019
18. Nematian J, Gholamrezanezhad A, Nematian E. Giardiasis and other intestinal parasitic infections in relation to anthropometric indicators of malnutrition: a large, population-based survey of schoolchildren in Tehran. Ann Trop Med Parasitol. 2008;102(3):209-14. https://doi.org/10.1179/136485908X267876
19. Muniz-Junqueira MI, Queiroz EF. Relationship between protein-energy malnutrition, vitamin A, and parasitoses in living in Brasília. Rev Soc Bras Med Trop. 2002;35(2):133-41. https://doi.org/10.1590/s0037-86822002000200002

20. Berkman DS, Lescano AG, Gilman RH, Lopez SL, Black MM. Effects of stunting, diarrhoeal disease, and parasitic infection during infancy on cognition in late childhood: a follow-up study. Lancet. 2002;359(9306):564-71. https://doi.org/10.1016/S0140-6736(02)07744-9
21. Chiu NC, Lin CY, Chi H, Yeung CY, Ting WH, Chan WT, Jiang CB, Li ST, Lin CH, Lee HC. Helicobacter pylori infection is not associated with failure to thrive: a case control study. Ther Clin Risk Manag. 2017;13:273-278. https://doi.org/10.2147/TCRM.S123148
22. Kocaoglu C, Ozel A, Cayci M, Solak ES. Effect of long-term Helicobacter pylori infection on growth of children: a cohort study. World J Pediatr. 2016;12(2):196-201. https://doi.org/10.1007/s12519-015-0021-7
23. Soylu OB, Ozturk Y. Helicobacter pylori infection: effect on malnutrition and growth failure in dyspeptic children. Eur J Pediatr. 2008;167(5):557-62. https://doi.org/10.1007/s00431-007-0552-6
24. Fialho AM, Braga AB, Queiroz DM, Rodrigues MN, Herbster ID, Braga LL. The association between Helicobacter pylori infection and height in children from an urban community in north-east Brazil. Ann Trop Paediatr. 2007;27(1):55-61. https://doi.org/10.1179/146532807X170510
25. Süoglu OD, Gökçe S, Saglam AT, Sökücü S, Saner G. Association of Helicobacter pylori infection with gastroduodenal disease, epidemiologic factors and iron-deficiency anemia in Turkish children undergoing endoscopy, and impact on growth. Pediatr Int. 2007;49(6):858-63. https://doi.org/10.1111/j.1442-200X.2007.02444.x
26. Chimonas MA, Baggett HC, Parkinson AJ, Muth PT, Dunaway E, Gessner BD. Asymptomatic Helicobacter pylori infection and iron deficiency are not associated with decreased growth among Alaska Native children aged 7-11 years. Helicobacter. 2006;11(3):159-67. https://doi.org/10.1111/j.1523-5378.2006.00395.x
27. Richter T, Richter T, List S, Müller DM, Deutscher J, Uhlig HH, Krumbiegel P, Herbarth O, Gutsmuths FJ, Kiess W. Five- to 7-year-old children with Helicobacter pylori infection are smaller than Helicobacter-negative children: a cross-sectional population-based study of 3,315 children. J Pediatr Gastroenterol Nutr. 2001;33(4):472-5. https://doi.org/10.1097/00005176-200110000-00010
28. Larson-Nath CM, Goday PS. Failure to Thrive: A Prospective Study in a Pediatric Gastroenterology Clinic. J Pediatr Gastroenterol Nutr. 2016;62(6):907-13. https://doi.org/10.1097/MPG.0000000000001099
29. El Mouzan MI, Assiri AM, Al Herbish AS, Al Sohaibani MO. Endoscopic duodenal biopsy in children. Saudi J Gastroenterol. 2006;12(1):31-3. https://doi.org/10.4103/1319-3767.27742
30. Stephenson LS, Latham MC, Ottesen EA. Malnutrition and parasitic helminth infections. Parasitology. 2000;121 Suppl:S23-38. https://doi.org/10.1017/s0031182000006491
31. Northrop-Clewes CA, Rousham EK, Mascie-Taylor CN, Lunn PG. Anthelmintic treatment of rural Bangladeshi children: effect on host physiology, growth, and biochemical status. Am J Clin Nutr. 2001;73(1):53-60. https://doi.org/10.1093/ajcn/73.1.53
32. Gendrel D, Treluyer JM, Richard-Lenoble D. Parasitic diarrhea in normal and malnourished children. Fundam Clin Pharmacol. 2003;17(2):189-97. https://doi.org/10.1046/j.1472-8206.2003.00169.x
33. Halliez MC, Buret AG. Extra-intestinal and long term consequences of Giardia duodenalis infections. World J Gastroenterol. 2013;19(47):8974-85. https://doi.org/10.3748/wjg.v19.i47.8974
34. Queiroz DM, Rocha AM, Crabtree JE. Unintended consequences of Helicobacter pylori infection in children in developing countries: iron deficiency, diarrhea, and growth retardation. Gut Microbes. 2013;4(6):494-504. https://doi.org/10.4161/gmic.26277
35. Owino V, Ahmed T, Freemark M, Kelly P, Loy A, Manary M, Loechl C. Environmental Enteric Dysfunction and Growth Failure/Stunting in Global Child Health. Pediatrics. 2016;138(6):e20160641. https://doi.org/10.1542/peds.2016-0641
36. Budge S, Parker AH, Hutchings PT, Garbutt C. Environmental enteric dysfunction and child stunting. Nutr Rev. 2019;77(4):240-253. https://doi.org/10.1093/nutrit/nuy068
37. Holguín L, Gallego-Yépes C, Toro Y, Díez-Zuluaga LS, Mopan J, Chinchilla C. Caracterización epidemiológica, clínica y diagnóstica de niños con gastroenteropatía eosinofílica. Estudio retrospectivo de tres instituciones de salud de alta complejidad. Rev Alerg Mex. 2018;65(2):148-159. https://doi.org/10.29262/ram.v65i2.354
38. Busoni VB, Lifschitz C, Christiansen S, G de Davila MT, Orsi M. Gastroenteropatía eosinofílica: una serie pediátrica. Arch Argent Pediatr. 2011;109(1):68-73. https://doi.org/10.1590/S0325-00752011000100019
39. Friesen CA, Kearns GL, Andre L, Neustrom M, Roberts CC, Abdel-Rahman SM. Clinical efficacy and pharmacokinetics of montelukast in dyspeptic children with duodenal eosinophilia. J Pediatr Gastroenterol Nutr. 2004;38(3):343-51. https://doi.org/10.1097/00005176-200403000-00021
40. Berezenko V, Bogdanova T, Krotevich M, Savenko Y, Vankhanova T. Morphological characteristics of chronic gastroduodenitis in adolescents with food hypersensitivity. Georgian Med News. 2018;(284):93-97.
41. Neilan NA, Dowling PJ, Taylor DL, Ryan P, Schurman JV, Friesen CA. Useful biomarkers in pediatric eosinophilic duodenitis and their existence: a case-control, single-blind, observational pilot study. J Pediatr Gastroenterol Nutr. 2010;50(4):377-84. https://doi.org/10.1097/MPG.0b013e3181c2c28a
42. Akbulut UE, Emeksiz HC, Kocak FG, Livaoglu A. Diagnostic yield of esophagogastroduodenoscopy in children with chronic abdominal pain. Arch Med

Sci. 2018;14(1):74-80. https://doi.org/10.5114/aoms.2017.67675
43. Thakkar K, Chen L, Tessier ME, Gilger MA. Outcomes of children after esophagogastroduodenoscopy for chronic abdominal pain. Clin Gastroenterol Hepatol. 2014;12(6):963-9. https://doi.org/10.1016/j.cgh.2013.08.041
44. Sierra D, Wood M, Kolli S, Felipez LM. Pediatric Gastritis, Gastropathy, and Peptic Ulcer Disease. Pediatr Rev. 2018;39(11):542-549. https://doi.org/10.1542/pir.2017-0234
45. Blanco Rodríguez G, García Cárdenas E, Velasco Sánchez F, Bernal Redondo RM, López Facio K, Faure Fontenla A, Penchyna Grub J, Valencia Mayoral P. Hallazgos clínico-patológicos en niños con nódulos duodenales. Patologia (Mex). 2011;49(4):257-261.
46. Pernas Gómez P, Iglesias Meleiro J, García Rodríguez C, Martiñón Sánchez F. Dos observaciones de hiperplasia nodular linfoide intestinal asociadas a déficits inmunitarios. An Pediatr. 2011;75(1):72-3. https://doi.org/10.1016/j.anpedi.2010.12.008
47. Gonul CD, Bilge C, Gazi KA, Filiz K. Duodenal nodularity in children: a clinical and pathologic study of 17 cases. Indian J Pathol Microbiol. 2011;54(2):312-7. https://doi.org/10.4103/0377-4929.81611