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**EDITORIAL**

- 4713 Diet and intestinal bacterial overgrowth: Is there evidence?  
*Souza C, Rocha R, Cotrim HP*

**MINIREVIEWS**

- 4717 Definition and classification of acute-on-chronic liver diseases  
*Zhang YY, Meng ZJ*
- 4726 Management of neurosurgical patients during coronavirus disease 2019 pandemics: The Ljubljana, Slovenia experience  
*Velnar T, Bosnjak R*

**ORIGINAL ARTICLE****Clinical and Translational Research**

- 4737 Glycolytic and fatty acid oxidation genes affect the treatment and prognosis of liver cancer  
*Zou JY, Huang YJ, He J, Tang ZX, Qin L*
- 4761 Detection of a novel panel of 24 genes with high frequencies of mutation in gastric cancer based on next-generation sequencing  
*Zeng HH, Yang Z, Qiu YB, Bashir S, Li Y, Xu M*

**Case Control Study**

- 4776 Outcomes of cervical degenerative disc disease treated by anterior cervical discectomy and fusion with self-locking fusion cage  
*Zhang B, Jiang YZ, Song QP, An Y*
- 4785 Impact of COVID-19 pandemic on clinicopathological features of transplant recipients with hepatocellular carcinoma: A case-control study  
*Akbulut S, Sahin TT, Ince V, Yilmaz S*

**Retrospective Study**

- 4799 Risk factors and optimal predictive scoring system of mortality for children with acute paraquat poisoning  
*Song Y, Wang H, Tao YH*
- 4810 Application effect of thoracoscopic tricuspid valvuloplasty in geriatric patients with tricuspid valve disease  
*Jiang W, Long XM, Wei KQ, Li SC, Zhang Z, He BF, Li H*
- 4818 Endoscopic ultrasonography in the evaluation of condition and prognosis of ulcerative colitis  
*Jin RF, Chen YM, Chen RP, Ye HJ*

- 4827 Dynamic interaction nursing intervention on functional rehabilitation and self-care ability of patients after aneurysm surgery

*Xie YE, Huang WC, Li YP, Deng JH, Huang JT*

#### Clinical Trials Study

- 4836 Validations of new cut-offs for surgical drains management and use of computerized tomography scan after pancreatoduodenectomy: The DALCUT trial

*Caputo D, Coppola A, La Vaccara V, Passa R, Carbone L, Ciccozzi M, Angeletti S, Coppola R*

#### Observational Study

- 4843 Psychosocial adaptation and influencing factors among patients with chemotherapy-induced peripheral neuropathy

*Zhou X, Wang DY, Ding CY, Liu H, Sun ZQ*

#### META-ANALYSIS

- 4856 Outcome of the efficacy of Chinese herbal medicine for functional constipation: A systematic review and meta-analysis

*Lyu Z, Fan Y, Bai Y, Liu T, Zhong LL, Liang HF*

#### CASE REPORT

- 4878 Familial gastrointestinal stromal tumors with *KIT* germline mutation in a Chinese family: A case report

*Yuan W, Huang W, Ren L, Xu C, Luan LJ, Huang J, Xue AW, Fang Y, Gao XD, Shen KT, Lv JH, Hou YY*

- 4886 Nonfunctional pancreatic neuroendocrine tumours misdiagnosed as autoimmune pancreatitis: A case report and review of literature

*Lin ZQ, Li X, Yang Y, Wang Y, Zhang XY, Zhang XX, Guo J*

- 4895 Sudden deafness as a prodrome of cerebellar artery infarction: Three case reports

*Li BL, Xu JY, Lin S*

- 4904 Importance of abdominal X-ray to confirm the position of levonorgestrel-releasing intrauterine system: A case report

*Maebayashi A, Kato K, Hayashi N, Nagaishi M, Kawana K*

- 4911 Bedside ultrasonic localization of the nasogastric tube in a patient with severe COVID-19: A case report

*Zhu XJ, Liu SX, Li QT, Jiang YJ*

- 4917 Paradoxical herniation after decompressive craniectomy provoked by mannitol: A case report

*Du C, Tang HJ, Fan SM*

- 4923 Targeted next-generation sequencing identifies a novel nonsense mutation in ANK1 for hereditary spherocytosis: A case report

*Fu P, Jiao YY, Chen K, Shao JB, Liao XL, Yang JW, Jiang SY*

- 4929 Nonfunctional bladder paraganglioma misdiagnosed as hemangioma: A case report

*Chen J, Yang HF*

- 4935** Special type of Wernekink syndrome in midbrain infarction: Four case reports  
*Yang YZ, Hu WX, Zhai HJ*
- 4942** Primary extraskeletal Ewing's sarcoma of the lumbar nerve root: A case report  
*Lei LH, Li F, Wu T*
- 4949** Yellow nail syndrome accompanied by minimal-change nephrotic syndrome: A case report  
*Zhang YN, Wang MH, Yu WC, Cheng W, Cong JP, Huang XP, Wang FF*
- 4957** Total femur replacement with 18 years of follow-up: A case report  
*Yang YH, Chen JX, Chen QY, Wang Y, Zhou YB, Wang HW, Yuan T, Sun HP, Xie L, Yao ZH, Yang ZZ*
- 4964** Male metaplastic breast cancer with poor prognosis: A case report  
*Kim HY, Lee S, Kim DI, Jung CS, Kim JY, Nam KJ, Choo KS, Jung YJ*
- 4971** CD8-positive indolent T-Cell lymphoproliferative disorder of the gastrointestinal tract: A case report and review of literature  
*Weng CY, Ye C, Fan YH, Lv B, Zhang CL, Li M*
- 4985** Bone flare after initiation of novel hormonal therapy in patients with metastatic hormone-sensitive prostate cancer: A case report  
*Li KH, Du YC, Yang DY, Yu XY, Zhang XP, Li YX, Qiao L*
- 4991** Postoperative infection of the skull base surgical site due to suppurative parotitis: A case report  
*Zhao Y, Zhao Y, Zhang LQ, Feng GD*
- 4998** Blunt aortic injury-traumatic aortic isthmus pseudoaneurysm with right iliac artery dissection aneurysm: A case report  
*Fang XX, Wu XH, Chen XF*
- 5005** Extensive complex thoracoabdominal aortic aneurysm salvaged by surgical graft providing landing zone for endovascular graft: A case report  
*Jang AY, Oh PC, Kang JM, Park CH, Kang WC*
- 5012** Gastric heterotopia of colon found cancer workup in liver abscess: A case report  
*Park JG, Suh JI, Kim YU*
- 5018** Clinical manifestations and gene analysis of Hutchinson-Gilford progeria syndrome: A case report  
*Zhang SL, Lin SZ, Zhou YQ, Wang WQ, Li JY, Wang C, Pang QM*
- 5025** Neurocutaneous melanosis with an intracranial cystic-solid meningeal melanoma in an adult: A case report and review of literature  
*Liu BC, Wang YB, Liu Z, Jiao Y, Zhang XF*
- 5036** Metastasis of liver cancer to the thyroid after surgery: A case report  
*Zhong HC, Sun ZW, Cao GH, Zhao W, Ma K, Zhang BY, Feng YJ*

- 5042** Spontaneous liver rupture following SARS-CoV-2 infection in late pregnancy: A case report  
*Ambrož R, Stašek M, Molnár J, Špička P, Klos D, Hambálek J, Skanderová D*
- 5051** Carotid blowout syndrome caused by chronic infection: A case report  
*Xie TH, Zhao WJ, Li XL, Hou Y, Wang X, Zhang J, An XH, Liu LT*
- 5057** Is repeat wide excision plus radiotherapy of localized rectal melanoma another choice before abdominoperineal resection? A case report  
*Chiu HT, Pu TW, Yen H, Liu T, Wen CC*
- 5064** Metaplastic breast cancer with chondrosarcomatous differentiation combined with concurrent bilateral breast cancer: A case report  
*Yang SY, Li Y, Nie JY, Yang ST, Yang XJ, Wang MH, Zhang J*
- 5072** Rare solitary splenic metastasis from a thymic carcinoma detected on fluorodeoxyglucose-positron emission tomography: A case report  
*Tsai YH, Lin KH, Huang TW*
- 5077** Type A aortic dissection following heart transplantation: A case report  
*Zeng Z, Yang LJ, Zhang C, Xu F*
- 5082** Catheter-related infections caused by *Mycobacterium abscessus* in a patient with motor neurone disease: A case report  
*Pan SF, Zhang YY, Wang XZ, Sun JJ, Song SL, Tang YR, Wang JL*
- 5088** Clear aligner treatment for a four-year-old patient with anterior cross-bite and facial asymmetry: A case report  
*Zou YR, Gan ZQ, Zhao LX*
- 5097** Knot impingement after arthroscopic rotator cuff repair mimicking infection: A case report  
*Kim DH, Jeon JH, Choi BC, Cho CH*
- 5103** Solitary primary pulmonary synovial sarcoma: A case report  
*He WW, Huang ZX, Wang WJ, Li YL, Xia QY, Qiu YB, Shi Y, Sun HM*
- 5111** Anesthetic management for intraoperative acute pulmonary embolism during inferior vena cava tumor thrombus surgery: A case report  
*Hsu PY, Wu EB*
- 5119** Delayed diagnosis of arytenoid cartilage dislocation after tracheal intubation in the intensive care unit: A case report  
*Yan WQ, Li C, Chen Z*

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## Diet and intestinal bacterial overgrowth: Is there evidence?

Claudineia Souza, Raquel Rocha, Helma Pinchemel Cotrim

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### Abstract

The intestinal microbiota and its role in health and disease processes have been the subject of several studies. It is known that changes in the intestinal microbiota occur due to several factors, such as the use of medication, age, lifestyle and diseases, which can modify intestinal homeostasis and lead to excessive growth of bacteria in the small intestine, triggering a clinical condition called small bowel bacterial overgrowth (SIBO). Individuals with SIBO may present gastrointestinal symptoms ranging from nausea, diarrhea and/or constipation, and flatulence to distension and abdominal pain, resulting from poor absorption of nutrients or changes in intestinal permeability. The gold-standard treatment is based on the use of antibiotics to eradicate bacterial overgrowth. Some studies have evaluated diets in the treatment of SIBO; however, the studies are of low methodological quality, making extrapolation of the results to clinical practice unfeasible. Thus, there is still not enough scientific evidence to support a specific type of diet for the treatment of SIBO.

**Key Words:** Small intestinal bacterial overgrowth; Treatment; Diet; Nutrition

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**Core Tip:** Some dietary interventions have been used in clinical practice for the treatment of small bowel bacterial overgrowth (SIBO); however, the available evidence to support such approaches is of low quality and scarce. Thus, the treatment of SIBO must be focused on controlling the underlying disease and observing the improvement in symptoms presented by the patient, as so far there is no specific diet for the treatment of SIBO.

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## INTRODUCTION

Small intestinal bacterial overgrowth (SIBO) is defined as a clinical condition caused by excessive numbers of small intestinal bacteria ( $\geq 10^3$  CFU/mL) that include predominantly gram-negative aerobic and anaerobic species[1]. In the physiological state, there are mechanisms to prevent excessive colonization of bacteria in the small intestine, such as an acidic stomach pH, pancreatic enzymes, the intestinal immune system, small intestine peristalsis, the ileocecal valve and the intestinal barrier itself. However, when changes in any of these mechanisms occur, SIBO can develop[2].

Given the growing knowledge on the intestinal microbiota and its role in health and disease processes, a series of studies have linked SIBO with diseases such as irritable bowel syndrome (IBS)[3], inflammatory bowel disease[4], nonalcoholic fatty liver disease[5], postgastrectomy syndrome[6] and several other conditions that are considered risk factors for the development of SIBO.

The main gastrointestinal symptoms are nausea, diarrhea and/or constipation, flatulence, distension and abdominal pain. Such symptoms may be due to poor absorption of nutrients or changes in intestinal permeability, as well as the inflammation and/or immune activation that result from pathological bacterial fermentation in the small intestine[7].

The noninvasive diagnostic method most commonly used in clinical practice is the measurement of hydrogen gas and/or methane exhaled in the breath after the ingestion of a fixed amount of a carbohydrate substrate. The indication of colonization by methanogens, which are not bacteria but belong to the Archaea domain, led to the proposal of a new term called intestinal overgrowth of methanogens. Given the diagnostic limitations, data on the prevalence of SIBO in the general population are unreliable, and the association of SIBO with the main risk factors is supported[1].

In terms of treatment, the use of antibiotics is currently the gold standard for eradicating bacterial overgrowth[1]. Rifaximin has been shown to be effective in the treatment of SIBO, despite the heterogeneity found in the studies as well as the lack of a recommendation regarding the dose and duration of treatment[8]. The antibiotics used are based on whether SIBO is associated with methane production (M-SIBO) or hydrogen production (H-SIBO). M-SIBO is associated with delayed small bowel and colon motility and is produced under anaerobic conditions. The treatment of M-SIBO tends to be easier than that of H-SIBO and is often associated with constipation. H-SIBO is associated with an overgrowth of gram-positive bacteria in the small intestine and usually manifests with diarrheal symptoms[9]. However, the recurrence rate after treatment with antibiotics is high, showing that there are no universally accepted treatment approaches for SIBO[1].

Regarding diet, studies have focused on diets with a reduction in fermentable products, involving an approach with few fibers and no gluten. The use of probiotics and phytotherapeutics has also been studied, but the results emphasize the need for well-conducted studies so that the results can be extrapolated to clinical practice[1,9].

## DIET AND SIBO: WHAT IS THE EVIDENCE

The principle for treating SIBO involves treating the underlying disease or condition to eradicate the bacterial overgrowth and possible associated nutritional deficiencies[10].

A recent systematic review included studies that evaluated the use of probiotics, an elemental diet, and herbal therapy for the treatment of SIBO[11]. It was observed that in randomized clinical trials that evaluated the use of probiotics, there was heterogeneity between the strains used and the duration of treatment, and regarding the methodological quality, most studies were of moderate quality. These results corroborate the position of the American College of Gastroenterology that treating SIBO with probiotics seems to be counterintuitive and that the studies published thus far are of low quality[1].

Although it may seem effective, an elemental diet is difficult to follow, and the literature lacks further studies for the clinical applicability of these diets. Regarding the use of medicinal herbs, although a few studies showed promising results in relation to the improvement of symptoms, these studies were of low methodological quality, and further studies are needed to standardize and prove the safety for the clinical applicability of these herbs[11].

Dietary strategies for the treatment of SIBO are based on a reduction in the consumption of fermentable products, which involves a diet low in fiber, sugar alcohols and other fermentable sweeteners such as sucralose. However, the dietary data for SIBO are an extension of nutritional therapy for IBS[3], highlighting diets low in fermentable oligosaccharides, disaccharides, monosaccharides and

polyols (FODMAPs), which are short-chain carbohydrates that are osmotically active and fermentable by small intestinal bacteria[1].

However, it is not clear whether the clinical improvement resulting from dietary changes is the result of a modification of the intestinal microbiota or is simply due to a reduction in fermentation and gas production. Although dietary modification is used in clinical practice for patients with SIBO, its role and effectiveness have not yet been determined[10].

It is important to highlight that the type and amount of bacteria found in the gastrointestinal tract depend on an individual's diet[12]. Thus, changes in the intestine lead to a significant impairment of nutrient absorption, including that of macronutrients and some vitamins[10]. In SIBO, some patients may show some signs of lactose intolerance, but it is believed to be bacterial lactose intolerance and not a deficiency of the lactase enzyme[13,14].

Other types of diets, such as a carbohydrate elimination diet and the "specific SIBO" diet, which are commonly disseminated on websites, do not have scientific evidence to support such a prescription.

Obese individuals seem to have an increased risk for SIBO[15], with an estimated prevalence of 41% [16] and with a predominance of bacteria from the phylum Firmicutes to the detriment of Bacteroidetes [17].

A recent meta-analysis in which most articles included were from Western countries, with only one Asian study, assessed the association between SIBO and obesity. It was observed that the risk for SIBO was three times higher among individuals with obesity than among individuals without obesity when evaluated only in the Western population[15]. This result highlights the importance that diet plays in the intestinal microbiota, since a Western diet rich in sugars and fats has been shown to reduce beneficial intestinal microorganisms in obese individuals[18].

However, the causal relationship between SIBO and obesity is not clear, and more comprehensive studies are needed that can consider ethnicity, eating habits and potential confounding factors[15].

Another meta-analysis with cohort studies evaluated the relationship of a usual diet, intestinal microbiota and intestinal inflammation, comparing patients with intestinal diseases with the general population. It was observed that a diet rich in plant foods, whole foods and sources of polyunsaturated fatty acids and polyphenols has the potential to prevent intestinal inflammatory processes, and these recommendations are plausible to increase the abundance of the intestinal microbiota[19].

Thus, despite studies showing apparently promising results, the quality of evidence of these studies is low, and these types of restrictive diets should not be maintained for long, as they are not nutritionally complete and are poor in important substrates for colonic bacteria, which can impact the goal of healthy colonization[1].

The recommended treatment for SIBO remains empirical, and consideration should be given to identifying and correcting underlying causes, correcting nutritional deficiencies and administering antibiotics[20].

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## CONCLUSION

Although diets for the treatment of SIBO seem promising, studies are still scarce and of low quality, limiting their clinical applicability. Therefore, it is important to be careful when prescribing restrictive diets, since the most severe cases of SIBO can cause malabsorption syndrome, which can lead to nutritional risk, and a healthy diet rich in vegetables and whole foods seems the best option to obtain a balanced microbiota. Thus, further studies with well-designed methodological designs are needed to support the clinical applicability of diets as treatments for SIBO.

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## FOOTNOTES

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