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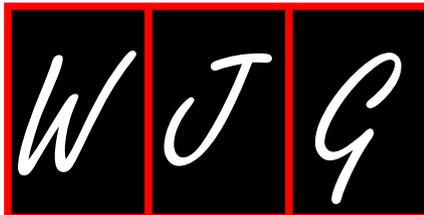
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Behavioral gastroenterology: An emerging system and new frontier of action

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Abstract

Behavioral gastroenterology is a new interdisciplinary science that explores the influence of unhealthy lifestyles and psychological factors on the digestive system and addresses the prevention, diagnosis, treatment, and rehabilitation of digestive diseases. Moreover, the concept of whole-course intervention with a focus on disease prevention and a new model of integrated therapy based on alterations of lifestyle and psychology are being gradually established. This paradigm may substantively impact the prevention and treatment of digestive diseases.

Key words: Behavioral gastroenterology; Lifestyle; Psychological factors

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Core tip: As a new interdisciplinary subject, behavioral gastroenterology shows a new concept of whole-course intervention with a focus on disease prevention and a new pattern of integrated therapy based on lifestyle and psychosocial adjustments. It will help both clinicians and patients to alter the old idea of focusing on traditional drugs or surgery, and this new paradigm is expected to become gastroenterology's new frontier of action.

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INTRODUCTION

Behavioral medicine, a phrase first coined at the Yale meeting in 1977, has been developing rapidly. In 2003, the new discipline of behavioral cardiology took a broad view, concluding that heart disease is not inevitable but rather may develop largely from psychosocial stress and unhealthy lifestyles such as smoking, overeating, and physical inactivity^[1]. Likewise, the effects of psychological-behavioral factors and unhealthy lifestyles on digestive diseases are no less impactful than those of traditional risk factors. Thus, by combining behavioral medicine and gastroenterology, a new pattern of psychological-behavioral treatment for gastroenterological patients has gradually emerged.

Based on the research that has integrated both traditional Chinese medicine and modern medicine, we established a behavioral gastroenterological group in the behavioral-psychosomatic medicine branch of the Guangdong Medical Association in 2012. The new concept of behavioral gastroenterology was first proposed in 2013. As an emerging field of clinical practice and an important part of behavioral medicine, behavioral gastroenterology comprehensively explores unhealthy lifestyles and behavioral-psychological factors that can affect the digestive system. This new discipline also addresses the prevention, diagnosis, and treatment of digestive diseases and rehabilitation of patients. Furthermore, a new concept of whole-course intervention with a focus on disease prevention and a new pattern of integrated therapy based on lifestyle/psychosocial adjustments have gradually been established. It is believed that both lifestyle and psychosocial factors can be improved by behavior modification, during which the patient and the practitioner work together.

BEHAVIORAL FACTORS AND DIGESTIVE DISEASES

Traditional Chinese medicine attaches great importance to lifestyle such as diet and daily routine, which are closely related to health and longevity. Similarly, modern medical research has also demonstrated that the onset of many digestive diseases is closely related to deviations in diet, sleep habits, work shifts, and poor lifestyle choices such as excessive alcohol consumption and tobacco use.

Dietary behavior

Certain types of foods are closely associated with symptoms of gastrointestinal diseases. For example, coffee, black pepper, chocolate, and onions often cause epigastric burning and heartburn, milk and dairy products, beans, bananas, and carbonated drinks often produce gas, and fresh meat, fried foods, wheat, manufactured goods, cakes, sweets, chocolate, citrus

fruits, beans, and onions often can cause early satiety. Wheat (93.33%), milk and manufactured goods containing milk products (83.33%), turnip (71.67%), bacon (55%), banana (53.33%), and onion (46.67%) often lead to intestinal smooth-muscle dysfunction, which constitutes a type of functional dyspepsia (FD)^[2]. Additionally, food consumption plays a key role in irritable bowel syndrome (IBS): more than 60% of IBS patients report the onset or worsening of symptoms after meals - within 15 min for 28% of patients, and within 3 h for 93% of patients^[3]. Most IBS patients (84%) report meal-related symptoms as a reaction to at least one specific food, such as milk and dairy products, beans, or apples^[4,5].

Eating behavior is also associated with digestive diseases. Gastroesophageal reflux disease (GERD) correlates with eating greasy or spicy food or drinking carbonated beverages^[6]. Patients with nonalcoholic fatty liver disease often consume high-energy foods and carbohydrates but ingest fewer foods rich in polyunsaturated fatty acids, vitamins, and minerals^[7]. Consumption of certain foods is closely correlated with digestive diseases. Long-term intake of hot foods and beverages positively correlates with the incidence of esophageal cancer^[8]. Fast intake (12 min or less) has been reported by about 40% of FD patients but in only 17% of healthy people. Compared with nonspecific FD, significant differences in the frequency of meal skipping and fast intake have been reported by patients with dysmotility-like FD and ulcer-like FD^[2]. A large-sample multicenter study in China found that refractory FD patients often have unhealthy eating habits such as skipping meals, eating extra meals, or a preference for sweet food and gas-producing food^[9].

Exercise behavior

A sedentary lifestyle is a risk factor for constipation and nonalcoholic fatty liver disease^[10-11]. Tuteja *et al.*^[12] reported that exercise does not affect symptoms such as constipation but can improve patients' quality of life. A meta-analysis revealed that physical exercise can reduce the risk of the occurrence of esophageal cancer, especially adenocarcinoma^[13].

Sleep behavior

GERD patients often report poor sleep quality^[14]. Fass *et al.*^[15] reported that 50.2% of 505 IBS patients suffer sleep disorders such as easy waking during nighttime sleep or fatigue in the morning. Their study also found that poor sleep quality decreases the threshold of visceral pain and that sleep disorders can induce and aggravate the symptoms of IBS. Sleep disorders have also been reported to be associated with the severity of symptoms and the comorbidity of anxiety for FD patients^[16].

Work behavior

A study found that working a rotating shift can

significantly increase the risk of gastrointestinal disorders and peptic ulcers^[17]. Nojkov *et al.*^[18] reported that the incidence of IBS is 48% for nurses with rotating shifts and 31% for nurses with strictly daytime work, and the probability of functional abdominal pain was 81% for nurses with rotating shifts, 54% for those with day shifts, and 61% for those with night shifts. Sleep quality is closely associated with IBS and the incidence of abdominal pain, which might be related to disruption of the circadian rhythm caused by rotating shifts.

Smoking and drinking habits

A large population-based study from developing countries indicated that smoking is not associated with GERD or epidemiologic FD; however, smoking is significantly associated with clinical FD, postprandial fullness, and epigastric pain^[19]. Lunney PC *et al.*^[20] found that the condition of patients with Crohn's disease can be worsened by smoking, and those investigators recommended that such patients quit smoking. In addition, long-term consumption of alcoholic beverages can induce lesions of the liver or pancreas, and alcohol directly damages the mucosa of the esophagus and stomach, modifies the sphincter pressure, impairs gastrointestinal mobility, and alters gastric acid output^[21].

PSYCHOLOGICAL FACTORS AND DIGESTIVE DISEASES

Psychological factors have received attention with respect to the occurrence and development of digestive diseases. A variety of psychological anomalies can be found in FD or IBS patients, especially those involving symptoms of anxiety and depression^[22]. A series of refractory functional gastrointestinal disease studies by our groups in recent years revealed that the incidence of anxiety and depression are 61.5% and 63.3%, respectively, for refractory FD patients, and the severity of anxiety and depression is greater than for non-refractory FD patients^[23]. Moreover, of 1057 patients, the incidence of anxiety and depression for FD patients with weight loss was 56.04% and 59.90%, respectively, and a higher incidence of anxiety and depression was found for patients of group A (lost \geq 5% of initial body weight) than for those of group B (lost < 5% of initial body weight)^[24]. Cruz Ruíz *et al.*^[25] reported that 58% of 100 IBS patients suffered anxiety, whereas 62% of those patients suffered depression, and female patients accounted for more than half. The incidence of symptoms of depression and anxiety was 66.2% and 65.5%, respectively, for the refractory IBS group, which was greater than that for the non-refractory IBS and control groups^[26]. Similarly, a significantly higher percentage of refractory globus patients have anxiety and depression compared with non-refractory globus patients. And the prevalence of moderate-to-severe

anxiety and depression was higher for the refractory globus group than for the non-refractory globus group^[27].

A study from Zhou *et al.*^[28] revealed that functional constipation patients have higher scores for depression and anxiety, and the anorectal squeezing pressure is negatively correlated with these scores; these results indicate that depression and anxiety may contribute to functional constipation. GERD patients are more likely to have emotions such as anxiety, depression, and pessimism than the general population, and such psychological disorders may make people vulnerable to GERD^[29].

BEHAVIORAL AND PSYCHOLOGICAL INTERVENTION

Behavioral gastroenterology advocates a new pattern of integrated therapy involving the adjustment of unhealthy lifestyles and psychological problems. This strategy is a shift from the former paradigm, which ascribed greater importance to the treatment of severe digestive diseases and complications. Furthermore, a series of effective behavioral and psychological interventions have been gradually established.

Dietary behavior intervention

Intermittent fasting is an internationally popular diet method that is effective for the control of body weight and the improvement of metabolic syndrome. Intermittent fasting generally entails normal intake for 5 d a week, but intake of a quarter of the normal calories for the other 2 d (usually 500 calories for females, 600 calories for males). A multicenter and large sample research demonstrated that patient body weight was reduced by 4.3 kg on average after 6 wk of intermittent fasting^[30]. Halberg *et al.*^[31] found that healthy people who underwent 2 wk of intermittent fasting exhibited no obvious body weight loss, but they did show improved insulin sensitivity - that is, the capacity for glucose storage and fat decomposition was increased. This result may be the key to improving metabolic syndrome.

A diet low in fermentable oligosaccharides, disaccharides, monosaccharides, and polyols (FODMAP) (Table 1) has been used recently for the management of functional gastrointestinal symptoms for IBS patients. Eswaran *et al.*^[32] showed that the low FODMAP diet led to a significant improvement in IBS symptoms, particularly pain and bloating. Staudacher *et al.*^[33] reported that more patients in the low FODMAP group expressed satisfaction with their symptom response (76%) compared with the standard-diet group (54%).

Intake control has received increasing attention, and intake reduction has been adopted by the majority of people. The strategy of "eating until you are 60% full", which was reported by the Healthy Aging Research Center of the University of London, was

Table 1 FODMAP food list

Food category	Low FODMAP food (things good to intake)	High FODMAP food (things to avoid/reduce)
Vegetables and Legumes	Alfalfa, Bean sprouts, Brussel sprouts, Butternut squash, Callaloo, Carrots, Celery, Chick peas, Chilli, Chives, Cho cho, Choy sum, Collard greens, Corn, Cucumber, Fennel, Green beans, Green pepper, Ginger, Leek leaves, Lentils	Garlic, Onions, Artichoke, Asparagus, Baked beans, Beetroot, Black beans, Cassava, Cauliflower, Falafel, Leek bulb, Mange Tout, Mixed vegetables, Mushrooms, Peas, sugar snap, Savoy Cabbage, Shallots, Taro
Fruit	Ackee, Bananas, Bilberries, Blueberries, Breadfruit, Cranberry, Clementine, Dragon fruit, Grapes, Kiwifruit, Lime, Mandarin, Orange, Passion fruit, Paw paw, Papaya, Pineapple, Plantain, peeled, Raspberry, Strawberry, Tamarind, Tangelo	Apples, Apricots, Avocado, Blackberries, Blackcurrants, Cherries, Currants, Dates, Goji berries, Grapefruit, Lychee, Mango, Peaches, Pears, Pineapple, Plums, Prunes, Sultanas, Tamarillo, Watermelon
Meats, Poultry, and Meat substitutes	Beef, Chicken, Kangaroo, Lamb, Pork, Prosciutto, Quorn, mince, Turkey, Cold cuts/deli meat/cold meats	Chorizo, Sausages, Processed meat - check ingredients
Fish and seafood	Canned tuna, Fresh fish (e.g., Cod, Haddock, Plaice, Salmon, Trout, Tuna), Seafood (e.g., Crab, Lobster, Mussels, Oysters, Prawns, Shrimp)	—
Cereals, Grains, Breads, Biscuits, Pasta, Nuts, and Cakes	Wheat free breads, Gluten free breads, Almonds, Biscuit, savoury, Biscuit, shortbread, Brazil nuts, Bulgur, Buckwheat, Brown rice, Chestnuts, Cornflour, Polenta, Popcorn, Potato flour, Pretzels, Quinoa, Rice, Sorghum, Walnuts	Wheat containing products, Almond meal, Amaranth flour, Barley including flour, Bran cereals, Bread, Cashews, Cous cous, Einkorn flour, Freekeh, Gnocchi, Muesli bar, Pistachios, Rye, Rye crispbread, Semolina, Spelt flour
Condiments, Dips, Sweets, Sweeteners, and Spreads	Aspartame, Acesulfame K, Barbecue sauce, Capers in vinegar, Capers, salted, Chocolate, Garlic infused oil, Golden syrup, Glucose, Marmalade, Marmite, Soy sauce, Stevia, Sweet and sour sauce, Sucralose, Sugar, Vegemite, Vinegars	Agave, Caviar dip, Fructose, Fruit bar, Hummus, Honey, Jam mixed berries/strawberry, Pesto sauce, Quince paste, Relish /vegetable pickle, Stock cubes, Sugar free sweets containing polyols, Sweeteners, Tahini paste, Tzatziki dip
Drinks and protein Powders	Drinking chocolate powder, Espresso, regular, black, Fruit juice (125 mL and safe fruits only), Malted chocolate powder, Tea (Chai tea weak, Green tea, Peppermint tea, White tea), Water	Beer, Coconut water, Cordial, Fruit juices made of apple, pear, mango and Orange, Rum, Sodas containing High Fructose Corn Syrup (HFCS), Soy milk, Sports drinks, Wine
Dairy foods	Butter, Dairy free chocolate pudding, Eggs, Margarine, Soy protein, Tempeh, Tofu, Whipped cream, Yoghurt with lactose free	Buttermilk, Cheese, Cream, Custard, Gelato, Ice cream, Kefir, Milk, Sour cream, Yoghurt

observed to extend the average lifespan of mice for five or six months - that is, it prolonged life by 30%. This would correspond to 20 years in humans.

Exercise behavior intervention

De Schryver *et al*^[34] found that regular physical activity (including 30 min of brisk walking and 11 min a day family project) could significantly improve defecation problems (e.g., overly frequent defecation, laborious defecation, and hard stools) caused by a lack of activity in middle-aged patients with chronic idiopathic constipation and significantly shorten the transit time in the sigmoid colon and rectum colon.

In addition, the results from Matsuzaki *et al*^[35] revealed that the intensity of regular exercise is independently associated with gastric emptying in healthy individuals, and gastric emptying was significantly faster in the low-intensity exercise group than in the moderate-intensity exercise group. It is trusted to be an optimal exercise intervention for the treatment of FD.

Life behavior intervention

Nowak *et al*^[36] implemented lifestyle adjustments for 23 patients with GERD during one month such as not leaning in during the 2 to 3 h after a meal, having more meals a day but less food at each meal, and a low-fat diet. The frequency and severity of GERD symptoms significantly decreased for 22 patients, and 11 patients reduced their use of GERD-specific drugs.

A report from Eherer *et al*^[37] revealed that

abdominal breathing training combined with proton pump inhibitors was more effective than proton pump inhibitors alone for the treatment of GERD. Thus, non-drug lifestyle intervention therapy can effectively improve symptoms and reduce the medication burden of patients.

Psychological intervention

Psychological factors are considered to be closely related to functional digestive diseases such as FD, IBS, GERD, and globus. Therefore, it is very important to quickly determine the causes of the psychological problems and help solve them. At the same time, appropriate drugs that can alleviate emotions should be used.

We performed a series of treatment research on the application of low-dose antidepressants in depressive patients with functional gastrointestinal diseases. Amitriptyline (25 mg/d) was used to treat globus patients. After 4 wk of treatment, the amitriptyline group showed significantly greater improvement in the Glasgow Edinburgh Throat Scale score and sleep quality than the group that received conventional treatment (pantoprazole, 40 mg/d)^[38]. Paroxetine (20 mg/d) was also applied for globus treatment. After 6 wk of treatment, 71.7% of the subjects in the paroxetine group (33/46) exhibited a treatment response, which was significantly greater than those for the amitriptyline group (46.2%, 24/52) and the lansoprazole group (14.0%, 7/50). A more distinct improvement of emotional well-being, quality of life,

and quality of sleep was observed in the paroxetine group than in the lansoprazole or amitriptyline group^[39]. Additionally, mirtazapine (30 mg/d) was utilized to treat the FD patients with weight loss. After 8 wk of treatment, mirtazapine not only alleviated symptoms associated with dyspepsia and depression linked to FD for patients with weight loss but also significantly increased body weight (mainly the visceral fat in body fat)^[40].

The low-dose administration of antidepressants mentioned above may not only alleviate the symptoms of depression but also improve the patient's digestive symptoms. Because these satisfactory effects can be achieved at low medical cost, the treatments are worth promoting in the clinic.

CONCLUSION

Unhealthy lifestyle and psychological factors are closely related to the occurrence, development, curative effect, and prognosis of digestive diseases. Thus, the new concept of whole-course intervention with a focus on disease prevention, and the new model of integrated therapy for the adjustment of unhealthy lifestyles and psychological problems are being established. As a new interdisciplinary subject, behavioral gastroenterology will help both clinicians and patients to alter the old idea of focusing on traditional drugs or surgery while ignoring lifestyle adjustments, and this new paradigm is expected to become gastroenterology's new frontier of action.

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