

Research Article

Prevalence and Predictors of Gastrointestinal Motility Disorders in Patients with Diabetes Mellitus

Shaista Mujeeb¹, Mujeeb-ur-Rehman Abro², Mumtaz Ali Chhutto³, Kamran Ali Memon⁴, Saad Ali Ansari⁵, Barkat Ali Dahar⁶

¹Lecturer, Department of Biochemistry, Shaheed Mohtarma Benazir Bhutto Medical University, Larkana, Pakistan.

²Assistant Professor, Department of Diabetes & Endocrinology, Shaheed Mohtarma Benazir Bhutto Medical University, Larkana, Pakistan.

³Associate Professor, Department of Medicine Unit-2, Chandka Medical College Hospital, Shaheed Mohtarma Benazir Bhutto Medical University, Larkana, Pakistan.

⁴Senior Registrar, Department of Gastroenterology, Hepatology & Nutrition, Gambat Institute of Medical Sciences, Gambat.

⁵Medical Officer, Chandka Medical College Hospital, Larkana, Pakistan.

⁶Assistant Professor, Department of Physiology, Khairpur Medical College, Khairpur Mir's, Pakistan.

Corresponding Author: Dr. Kamran Ali Memon

Senior Registrar, Department of Gastroenterology, Hepatology & Nutrition, Gambat Institute of Medical Sciences, Gambat, Pakistan.

Email: drkamranali26@gmail.com

Received: 22.04.2026, Revised: 19.06.2026, Accepted: 23.06.2026

ABSTRACT

Background: Gastrointestinal motility disorders are common but often under-recognized complications of diabetes mellitus and may affect nutrition, glycemic stability, and quality of life.

Objective: To determine the prevalence and predictors of gastrointestinal motility disorders in patients with diabetes mellitus.

Methodology: This cross-sectional analytical study was conducted at Department of Biochemistry, Shaheed Mohtarma Benazir Bhutto Medical University, Larkana from 1st October 2025 to 31st March 2026 including 190 patients with diabetes mellitus.

Results: Gastrointestinal motility disorders were present in 92 (48.4%) patients. The most common manifestations were gastroesophageal dysmotility/reflux symptoms in 44 (23.2%), suspected diabetic gastroparesis in 38 (20.0%), constipation/colonic dysmotility in 34 (17.9%), and diabetic enteropathy in 26 (13.7%). Patients with motility disorders had higher age (57.8 ± 10.9 vs. 50.8 ± 11.4 years), longer diabetes duration (11.6 ± 5.1 vs. 6.8 ± 4.2 years), higher body mass index (30.7 ± 4.9 vs. 28.1 ± 4.2 kg/m²), and higher HbA1c ($9.4 \pm 1.7\%$ vs. $7.8 \pm 1.3\%$). HbA1c $\geq 9\%$ was the strongest predictor of gastrointestinal motility disorders (aOR 3.92; $p < 0.001$), followed by peripheral neuropathy (aOR 3.48), diabetes duration > 10 years (aOR 3.11), autonomic neuropathy (aOR 2.94), female gender (aOR 2.26), and body mass index ≥ 30 kg/m² (aOR 2.18).

Conclusion: Gastrointestinal motility disorders are highly prevalent in diabetic patients and are significantly associated with poor glycemic control, longer diabetes duration, neuropathy, obesity, and female gender.

Keywords: Diabetes Mellitus, Gastrointestinal Motility Disorders, Gastroparesis, Diabetic Enteropathy, Glycemic Control, Neuropathy.

INTRODUCTION

Diabetes mellitus is a chronic metabolic condition characterized by chronic hyperglycemia due to inadequate insulin production, impaired insulin action, or both.¹ There are several complications of diabetes, including those of the cardiovascular, renal, neurological, ophthalmic, and gastrointestinal systems, that are associated with long-standing diabetes.² While microvascular and macrovascular complications have been highlighted in clinical practice, gastrointestinal

complications of diabetes are common and can significantly impact quality of life.³ Gastrointestinal motility disorders are associated with autonomic neuropathy, enteric nervous system dysfunction, smooth muscle impairment associated with hyperglycemia, altered gut hormone regulation, and changes in the intestinal microbiota in diabetic patients.⁴ These are disorders affecting any part of the gastrointestinal tract and can manifest as dysphagia, early satiety, nausea, vomiting, bloating, abdominal pain, diarrhoea,

gastrointestinal reflux symptoms, fecal incontinence or constipation.⁵

Delayed gastric emptying in the absence of mechanical obstruction is one of the most recognised motility disorders and is known as diabetic gastroparesis.⁶ It typically manifests symptoms of nausea, vomiting, postprandial fullness, early satiety, and bloating, and can contribute to poor nutritional status and erratic glycemic control.⁷ Other complications of diabetic enteropathy include chronic diarrhoea, constipation, abdominal discomfort, and changes in bowel habits because of decreased intestinal motility and autonomic dysfunctions.⁸

There is considerable variability between different studies in the prevalence of gastrointestinal motility disorders in diabetes, due to the differences in the definitions used, study populations, length of diabetes, glycemic control, and assessment methods.⁹ There is much underdiagnosis because gastrointestinal symptoms are commonly attributed to dietary habits, medication use, and functional bowel disorders or other gastrointestinal diseases that have nothing to do with bowel cancer.¹⁰ This under-recognition can lead to a delay in treatment and deterioration of patient outcomes. Various risk factors have been linked to gastrointestinal motility disorders in diabetes, such as decreased glycemic control, diabetes mellitus for a longer time, autonomic neuropathy, peripheral neuropathy, female gender, obesity, and certain medications that have effects on gastrointestinal motility.¹¹

Adverse effects of chronic hyperglycemia on gastric and intestinal motor function also exist, and repeated fluctuations in glucose levels might add to the autonomic regulation disturbances.¹² Thus, glycemic control is important both in the onset and progression of diabetic gastrointestinal complications. An approach to diagnosis of diabetes mellitus involves careful clinical evaluation, with appropriate investigation when necessary, to ensure the correct diagnosis is made.¹³ Depending upon clinical presentation, symptom-based assessment tools, gastric emptying studies, endoscopy, abdominal imaging, colonic transit studies, and autonomic function testing can be used.¹⁴ Early diagnosis is crucial as these disorders can cause disruption of eating, absorption of medications, glucose regulation, and management of metabolism.¹⁵ Optimization of glycemic control, dietary modification, medication review, prokinetic agents, laxatives or antidiarrheal therapy, and therapy of associated neuropathy, if appropriate, are all

preventive and therapeutic measures.¹⁶ However, there is limited local data available about the burden and predictors of gastrointestinal motility disorders among diabetic patients.

MATERIALS AND METHODS

This was a cross-sectional analytical study conducted at Department of Biochemistry, Shaheed Mohtarma Benazir Bhutto Medical University, Larkana from 1st October 2025 to 31st March 2026 including 190 patients with diagnosed diabetes mellitus to determine the prevalence and predictors of gastrointestinal motility disorders. Adults (age 18 years or older), who had been diagnosed with diabetes mellitus (Type 1 or Type 2) for at least one year, were included. Patients who attended the outpatient diabetic clinic or were admitted for evaluation for diabetes and were having gastrointestinal symptoms or had given consent for gastrointestinal evaluation were also included. Patients with full clinical and laboratory data were selected. Those patients who had a prior history of structural gastrointestinal disease (peptic ulcer disease, inflammatory bowel disease, gastrointestinal malignancy, gastrointestinal obstruction, or a history of major gastrointestinal surgery) were excluded. Where appropriate, patients taking drugs that can have a significant effect on gastrointestinal motility, such as chronic opioid therapy, were excluded. People with active gastrointestinal infection, pregnant women, severely ill persons with non-diabetic conditions, connective tissue disorders with gut motility effect and poor diagnostic history were also excluded.

Demographic and clinical parameters used as baseline data were age, gender, duration of diabetes, body mass index (BMI), smoking status, hypertension, dyslipidaemia, diabetic complications (peripheral neuropathy and autonomic neuropathy), medication history and glycemic control status. Symptom-based assessment criteria were used to document gastrointestinal symptoms, which included early satiety, nausea, vomiting, bloating, abdominal pain, constipation, diarrhoea, gastroesophageal reflux symptoms, and altered bowel habits. Laboratory tests were fasting blood glucose, HbA1c, renal profile, electrolyte, and relevant metabolic tests. Supportive diagnostic tests like abdominal ultrasonography, upper gastrointestinal endoscopy, gastric emptying study, or colonic transit study were reviewed

when clinically indicated, in order to aid diagnosis.

Data were analyzed using SPSS-26.0. Patients who had gastrointestinal motility disorders were compared with those who did not have them by the Chi-square test and the independent t-test. Independent predictors of gastrointestinal motility disorders were determined by multivariable logistic regression analysis. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

The mean age was 54.2 ± 11.6 years, and most were 89 (46.8%) between aged 45–59 years. Females were slightly more common 106 (55.8%). The mean diabetes duration was 9.1 ± 5.4 years, while mean BMI was 29.4 ± 4.8 kg/m². Hypertension and dyslipidemia were present in 118 (62.1%) and 102 (53.7%) patients, respectively. Peripheral neuropathy was noted in 76 (40.0%) and autonomic neuropathy in 48 (25.3%), with mean HbA1c of $8.6 \pm 1.8\%$ (Table 1).

Gastrointestinal motility disorders were present in 92 (48.4%) patients, showing a high burden among diabetics. Gastroesophageal

dysmotility/reflux symptoms were most frequent 44 (23.2%), followed by suspected diabetic gastroparesis 38 (20%), constipation or colonic dysmotility 34 (17.9%), and diabetic enteropathy 26 (13.7%). The commonest symptoms were bloating 56 (29.5%), abdominal discomfort 47 (24.7%), early satiety 43 (22.6%), reflux symptoms 41 (21.6%), and constipation 39 (20.5%) [Table 2, Fig. 1].

Patients with GI motility disorders were older (57.8 ± 10.9 vs. 50.8 ± 11.4 years; $p < 0.001$), had longer diabetes duration (11.6 ± 5.1 vs. 6.8 ± 4.2 years; $p < 0.001$), higher BMI (30.7 ± 4.9 vs. 28.1 ± 4.2 kg/m²; $p < 0.001$), and poorer glycemic control (HbA1c $9.4 \pm 1.7\%$ vs. $7.8 \pm 1.3\%$; $p < 0.001$) [Table 3].

Multivariable analysis showed that HbA1c $\geq 9\%$ was the strongest predictor of GI motility disorders (aOR 3.92; 95% CI: 1.98–7.75; $p < 0.001$). Other significant predictors included peripheral neuropathy (aOR 3.48; $p < 0.001$), diabetes duration > 10 years (aOR 3.11; $p = 0.002$), autonomic neuropathy (aOR 2.94; $p = 0.007$), female gender (aOR 2.26; $p = 0.02$), and BMI ≥ 30 kg/m² (aOR 2.18; $p = 0.03$) [Table 4].

Table 1: Demographic, Clinical and Metabolic Characteristics of Diabetic Patients (N = 190)

Variable	No.	%
Age (Years)		
<45	36	18.9
45–59	89	46.8
≥ 60	65	34.2
Gender		
Male	84	44.2
Female	106	55.8
Duration Of Diabetes (Years)		
<5	42	22.1
5–10	79	41.6
> 10	69	36.3
Body Mass Index (Kg/M ²)		
Overweight (Kg/M ²)	72	37.9
Obesity (Kg/M ²)	86	45.3
Metabolic Characteristics		
Hypertension	118	62.1
Dyslipidemia	102	53.7
Peripheral Neuropathy	76	40.0
Autonomic Neuropathy	48	25.3

Table 2: Prevalence and Clinical Spectrum of Gastrointestinal Motility Disorders Of Diabetic Patients (N = 190)

Variable	No.	%
Any Gastrointestinal Motility Disorder	92	48.4
Suspected Diabetic Gastroparesis	38	20.0

Chronic Constipation/Colonic Dysmotility	34	17.9
Diabetic Enteropathy (Diarrhea/Irregular Bowel Habits)	26	13.7
Gastroesophageal Dysmotility/Reflux Symptoms	44	23.2
Symptoms		
Bloating	56	29.5
Early Satiety	43	22.6
Nausea	35	18.4
Vomiting	19	10.0
Abdominal Pain/Discomfort	47	24.7
Constipation	39	20.5
Diarrhea	24	12.6
Reflux Symptoms	41	21.6

Table 3: Comparative Analysis between Patients with and Without Gastrointestinal Motility Disorders (N = 190)

Variable	GI Motility Disorder		P-Value
	Present (N=92)	Absent (N=98)	
Age (Years)	57.8±10.9	50.8 ± 11.4	<0.001
Females	61 (66.3%)	45 (45.9%)	0.005
Duration Of Diabetes (Years)	11.6±5.1	6.8±4.2	<0.001
BMI (Kg/M ²)	30.7±4.9	28.1±4.2	<0.001
Hba1c (%)	9.4±1.7	7.8±1.3	<0.001
Peripheral Neuropathy	54 (58.7%)	22 (22.4%)	<0.001
Autonomic Neuropathy	35 (38.0%)	13 (13.3%)	<0.001
Hypertension	66 (71.7%)	52 (53.1%)	0.009

Table 4: Multivariable Logistic Regression Analysis for Predictors of Gastrointestinal Motility Disorders

Variable	Adjusted OR	95% CI	P-Value
Hba1c ≥9%	3.92	1.98–7.75	<0.001
Diabetes Duration >10 Years	3.11	1.54–6.28	0.002
Peripheral Neuropathy	3.48	1.72–7.04	<0.001
Autonomic Neuropathy	2.94	1.33–6.48	0.007
Female Gender	2.26	1.12–4.54	0.02
BMI ≥30 Kg/M ²	2.18	1.08–4.38	0.03

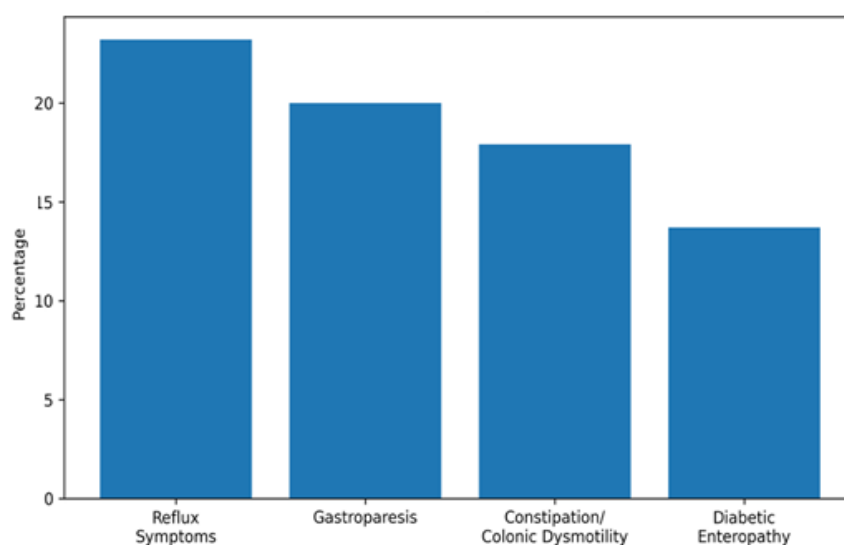


Fig. 1: Prevalence of Gastrointestinal Motility Disorders among Patients with Diabetes Mellitus

DISCUSSION

In the present study, high prevalence of gastrointestinal motility disorders among diabetic patients was observed, that is 92 (48.4%) patients had gastrointestinal motility disorders. Gastroesophageal dysmotility/reflux symptoms were the most common disorder 44 (23.1%) patients), followed by suspected diabetic gastroparesis 38 (20%), constipation/colonic dysmotility 34 (17.9%), and diabetic enteropathy 26 (13.7%). Another study found that gastrointestinal issues are frequently observed among those with diabetes, particularly reflux, bloating, early satiety, constipation and irregular bowel movements.¹⁷ The symptom pattern showed that bloating was the most frequent complaint, reported by 56 (29.5%) patients, followed by abdominal pain or discomfort in 47 (24.7%), early satiety in 43 (22.6%), reflux symptoms in 41 (21.6%), constipation in 39 (20.5%), nausea in 35 (18.4%), diarrhoea in 24 (12.6%), and vomiting in 19 (10%). From these results it is suggested that the diabetic gastrointestinal dysfunction involves both the upper and lower gastrointestinal tract. In another study, it was also found that diabetic gastrointestinal dysmotility is manifested by bloating, early satiety, nausea, reflux and change in bowel habits.¹⁸ Gastrointestinal motility disorders were associated with a significantly older mean age (57.8 ± 10.9 years) than disorders (50.8 ± 11.4 years; $p < 0.001$). They also had a longer duration of diabetes (11.6 ± 5.1 years versus 6.8 ± 4.2 years; $p < 0.001$), which would also be a risk factor for motility dysfunction in diabetes. A previous study also reported that older age and duration of diabetes was highly correlated with gastroparesis, constipation, and diabetic enteropathy.¹⁹

Motility disorders were very strongly associated with poor glycemic control. Patients with affected had significantly elevated mean HbA1c level ($9.4 \pm 1.7\%$) than patients with unaffected ($7.8 \pm 1.3\%$) [$p < 0.001$]. HbA1C $\geq 9\%$ was the best predictor of gastrointestinal motility disorders (aOR 3.92; 95% CI 1.98-7.75; $p < 0.001$) on regression analysis. Another study has shown that inadequate glycemic control causes autonomic nerve dysfunction and intestinal motor dysfunction that lead to delayed gastric emptying.²⁰ Other significant risk factors included were neuropathy. The peripheral neuropathy was found in 54 (58.7%) patients with affected eyes vs 22 (22.4%) patients with unaffected eyes whereas the autonomic neuropathy was present in 35 (38%) patients

with affected eyes vs 13 (13.3%) patients with unaffected eyes ($p < 0.001$). Peripheral neuropathy, (aOR 3.48; $p < 0.001$) and autonomic neuropathy (aOR 2.94; $p = 0.007$) were significant predictors with regression analysis. In a previous study, it was also shown that diabetic autonomic neuropathy is well correlated with delayed gastric emptying, constipation, diarrhoea and other motility disorders.²¹ Diabetic patients can benefit from a reduced burden of symptoms and improved quality of life if gastrointestinal symptoms are detected early, there is better glycemic control, there is weight management, and neuropathy is detected early.

Limitations: Being a single-center cross-sectional study, it cannot establish a causal relationship between diabetes-related factors and gastrointestinal motility disorders. Some symptoms were assessed clinically and may be affected by recall or reporting bias. Objective motility tests were not performed in all patients, which may have underestimated or overestimated the true prevalence. The sample size was moderate, limiting subgroup analysis. Medication effects, dietary habits, physical activity, and psychological factors were not fully controlled, although they may influence gastrointestinal symptoms.

CONCLUSION

Gastrointestinal motility disorders are prevalent in patients with diabetes mellitus, almost half of the study subjects had gastrointestinal motility disorder. The major presentations were reflux symptoms, suspected gastroparesis, constipation and diabetic enteropathy. Poor glycemic control, diabetes duration, peripheral neuropathy, autonomic neuropathy, obesity and female gender were significant predictors. It can be helpful to treat patients with diabetes to take steps to prevent or reduce the burden of symptoms, through early identification of gastrointestinal symptoms, optimisation of glycemic control, weight management and screening for diabetic neuropathy, and to improve patient quality of life.

REFERENCES

1. Hisada H, Tsuji Y, Kubota D, Miura Y, Mizutani H, Ohki D, et al. Impact of glucagon-like peptide-1 receptor agonists on retained gastric contents during esophagogastroduodenoscopy: a propensity score-matched study. *Dig Endosc* 2025;37(12):1340-47.

2. Oprea AD, Ostapenko LJ, Sweitzer B, Selzer A, Irizarry-Alvarado JM, et al. Perioperative management of patients taking glucagon-like peptide 1 receptor agonists: Society for Perioperative Assessment and Quality Improvement multidisciplinary consensus statement. *Br J Anaesth* 2025;135(1):48-78.
3. Wolla CD, Pecha TJ, Sirianni JM, Schorg LM, Wolf BJ, Wilson SH. Ultrasound assessment of preoperative gastric volume in fasted diabetic surgical patients: a prospective observational cohort study on the effects of glucagon-like peptide-1 agonists on gastric emptying. *J Clin Anesth* 2025;104:111853.
4. NCD Risk Factor Collaboration (NCD-RisC). Worldwide trends in diabetes prevalence and treatment from 1990 to 2022: a pooled analysis of 1108 population-representative studies with 141 million participants. *Lancet* 2024;404(10467):2077-93.
5. Weber MM. Trust the gold standard: all glucagon-like peptide-1 receptor agonists can delay gastric emptying. *Anesthesiology* 2024;140:178-80.
6. Nadeem D, Taye M, Still MD, McShea S, Satterfield D, Dove JT, et al. Effects of glucagon-like peptide-1 receptor agonists on upper endoscopy in diabetic and nondiabetic patients. *Gastrointest Endosc* 2024;100(4):745-9.
7. Nersessian RSF, da Silva LM, Carvalho MAS, Silveira SQ, Abib ACV, Bellicieri FN, et al. Relationship between residual gastric content and peri-operative semaglutide use assessed by gastric ultrasound: a prospective observational study. *Anaesthesia* 2024;79(12):1317-24.
8. Sen S, Potnuru PP, Hernandez N, Goehl C, Praestholm C, Sridhar S, et al. Glucagon-like peptide-1 receptor agonist use and residual gastric content before anesthesia. *JAMA Surg* 2024;159(6):660-67.
9. Perlas A, Xiao MZX, Tomlinson G, Jacob B, Abdullah S, Kruisselbrink R, et al. Baseline gastric volume in fasting diabetic patients is not higher than that in nondiabetic patients: a cross-sectional noninferiority study. *Anesthesiology* 2024; 140(4): 648-56.
10. Chapman MB, Norwood DA, Price C, Abdulhadi B, Kyanam Kabir Baig K, Ahmed AM, et al. Effects of glucagon-like peptide-1 receptor agonists on gastric mucosal visibility and retained gastric contents during EGD. *Gastrointest Endosc* 2024;100(5):923-7.
11. Garza K, Aminpour E, Shah J, Mehta B, Early D, Gyawali CP, et al. Glucagon-like peptide-1 receptor agonists increase solid gastric residue rates on upper endoscopy especially in patients with complicated diabetes: a case-control study. *Am J Gastroenterol* 2024;119(6):1081-8.
12. Shehata M, Al Hosani I, Singh Y, Alali A, Khan S, Al Zaabi M, et al. Factors associated with delayed gastric emptying in symptomatic diabetic and non-diabetic patients: a retrospective observational study. *Cureus* 2024;16(4):e58038.
13. Hashash JG, Thompson CC, Wang AY. AGA rapid clinical practice update on the management of patients taking GLP-1 receptor agonists prior to endoscopy: communication. *Clin Gastroenterol Hepatol* 2024;22:705-7.
14. Queiroz VNF, Falsarella PM, Chaves RC de F, Takaoka F, Socolowski LR, Garcia RG. Risk of pulmonary aspiration during semaglutide use and anesthesia in a fasting patient: a case report with tomographic evidence. *Einstein (Sao Paulo)* 2023; 21:eRC0628.
15. Gulak MA, Murphy P. Regurgitation under anesthesia in a fasted patient prescribed semaglutide for weight loss: a case report. *Can J Anaesth* 2023; 70:1397-1400.
16. Klein SR, Hobai IA. Semaglutide, delayed gastric emptying, and intraoperative pulmonary aspiration: a case report. *Can J Anaesth*. 2023;70:1394-96.
17. Silveira SQ, da Silva LM, de Campos Vieira Abib A, de Moura DTH, de Moura EGH, Santos LB, et al. Relationship between perioperative semaglutide use and residual gastric content: a retrospective analysis of patients undergoing elective upper endoscopy. *J Clin Anesth* 2023; 87: 111091.
18. Kobori T, Onishi Y, Yoshida Y, Tahara T, Kikuchi T, Kubota T, et al. Association of glucagon-like peptide-1 receptor agonist treatment with gastric residue in an esophagogastroduodenoscopy. *J Diabetes Investig* 2023;14(6):767-73.
19. Liu BD, Udemba SC, Liang K, Tarabichi Y, Hill H, Fass R, et al. Shorter-acting glucagon-like peptide-1 receptor agonists are associated with increased development of gastro-oesophageal

- reflux disease and its complications in patients with type 2 diabetes mellitus: a population-level retrospective matched cohort study. *Gut* 2023;73(2):246-54.
20. Kazeminia M, Salari N, Shohaimi S, Akbari H, Mohammadi M. Prevalence of gastrointestinal complications in patients with type 2 diabetes mellitus in Iran: a systematic review and meta-analysis. *J Diabetes Metab Disord* 2022;21:1029-1036.
21. Sena E, Silva DVL, Américo MF, Nascimento JWG, Miranda JRA, Corá LA. Gastrointestinal motility in elderly patients with well-controlled type 2 diabetes mellitus. *Arq Gastroenterol* 2022;59:231-237.