Supplementary material

Sleep quality and anxiety burden in functional dyspepsia: A cross-sectional study in a general hospital

Supplementary Methods

Scale administration

The four rating-scale assessments were collected prospectively during the same clinical visit under a standardized departmental assessment protocol, after the diagnosis of functional dyspepsia and upper gastrointestinal endoscopy had been completed. The present study retrospectively abstracted and analyzed these previously collected data; the scales were not administered retrospectively for research purposes. The Chinese-language 14-item Hamilton Anxiety Rating Scale (HAMA) and Chinese 17-item Hamilton Depression Rating Scale (HAMD-17) were administered face to face as clinician-rated assessments by one of three trained gastroenterologists. The instruments also included the Chinese Pittsburgh Sleep Quality Index (PSQI) and Chinese-language Gastrointestinal Quality of Life Index (GIQLI). The PSQI and GIQLI were administered by physicians in interview format based on patient-reported responses. Reliability, validity, and sensitivity-to-change evidence for HAMA was reported by Maier et al.[18]; Chinese HAMD-17 validation by Zheng et al.[19]; preliminary reliability and validity evidence for a Chinese PSQI version in people living with HIV by Yan et al.[20], with additional psychometric evidence from Tsai et al.[21]; and Chinese GIQLI translation/validation evidence by Yeung et al.[22], with additional evidence from Lien et al.[23]. HAMA ≥ 14, HAMD-17 ≥ 8, and PSQI > 7 were operational definitions of symptom burden and did not constitute psychiatric diagnoses. The Chinese-language instruments used in this study were those routinely used under the department's standardized clinical assessment protocol. Published psychometric or validation studies, including available Chinese-language studies where applicable, are cited as supporting measurement evidence. Because the archived records did not preserve the exact translator, version identifier, or licensing documentation of the historical local forms, their exact correspondence to a specific published or authorized Chinese version could not be retrospectively verified.

Rater training

Three gastroenterologists administered the study scales. The department head organized one training session of approximately 1 hour using Chinese-language scoring materials. The session included discussion of the scoring criteria. Each patient was rated by one gastroenterologist, and difficult ratings were reviewed by a senior gastroenterologist. Formal inter-rater reliability statistics such as the intraclass correlation coefficient or kappa could not be estimated because independent duplicate ratings were not performed.

Missing-data and selection-bias assessment

Among 236 patients assessed, 50 were excluded and 186 constituted the final analytic sample. For the flow diagram, the assigned primary exclusion reasons were missing all four study rating-scale assessments (n = 25), documented psychiatric history (n = 12), and gastrointestinal motility-agent use within 4 weeks before assessment (n = 13). Individual patients could meet more than one exclusion criterion; each excluded patient was assigned one primary reason for the flow diagram. Basic clinical data remained available for the 25 patients missing all four rating scales. These patients were compared with the 186 included patients using conventional group comparisons and standardized mean differences (SMDs). Conventional P values did not identify statistically significant differences, but the SMDs indicated possible imbalance in several characteristics. Accordingly, selection bias could not be excluded. Within the 186-person analytic cohort, all variables used in the reported analyses were complete. The 25 pre-analysis exclusions for missing all four scales were therefore distinct from post-inclusion covariate missingness. No imputation was performed.

Sensitivity-analysis definitions

The primary outcome was HAMA-defined anxiety symptom status. The primary clinically informed logistic model included female sex, age, disease duration ≥2 years, symptom severity, poor sleep quality, concomitant irritable bowel syndrome (IBS), and functional dyspepsia subtype, with epigastric pain syndrome (EPS) as the subtype reference. Covariates were selected according to clinical relevance, prior evidence, and potential confounding rather than univariable P values. Sensitivity analyses examined whether the primary findings depended on dichotomized definitions by entering disease duration continuously per year, PSQI continuously per point, or both disease duration and PSQI continuously while retaining the remaining clinically informed covariate structure. An additional IBS-excluded sensitivity analysis assessed robustness to concomitant IBS by excluding 34 patients with concomitant IBS and refitting the clinically informed logistic model without the IBS term; the model retained female sex, age, disease duration ≥ 2 years, symptom severity, poor sleep quality, and FD subtype, with EPS as the reference category.

The exploratory cross-sectional path analysis decomposed the PSQI-GIQLI association into direct and indirect statistical components through HAMA score while adjusting for age, sex, continuous disease duration, and functional dyspepsia subtype. The analysis used standardized coefficients and 5000 bootstrap resamples. It does not establish temporal ordering, causal mediation, or biological mechanisms.

Regression diagnostics

For the primary logistic model, linearity in the logit was assessed for age and symptom severity using Box-Tidwell terms and a joint likelihood-ratio test. For the primary and HAMD-17-adjusted GIQLI models, residual distribution was assessed by the Shapiro-Wilk test, heteroscedasticity by the Koenker-Breusch-Pagan test, linearity by the Ramsey RESET test, and influence using Cook's distance, leverage, and externally studentized residuals. These were diagnostic checks only; no observations were deleted and no substantive model was re-specified. For the continuous disease-duration sensitivity model, linearity in the logit was assessed using a Box-Tidwell term. Because PSQI included zero values, PSQI linearity was assessed using a natural restricted cubic spline versus linear PSQI likelihood-ratio test without adding an offset or constant. Corresponding component and joint likelihood-ratio tests were used for the both-continuous model.

Supplementary Table 1 Assessment instruments

Instrument	Version used	Administration in the present study	Number of items	Score range	Scoring	Study operational cutoff	Original reference	Psychometric or validation evidence	Access/copyright information
HAMA	Chinese-language 14-item Hamilton Anxiety Rating Scale	Face-to-face clinician-rated assessment by one of three trained gastroenterologists	14	0-56	Each item scored 0-4; total score is the sum of item scores	≥14 for HAMA-defined anxiety symptom status; operational threshold, not a psychiatric diagnosis	Hamilton 1959 [14]	Maier et al., 1988 [18] - reliability, validity, and sensitivity-to-change evidence for HAMA generally. The cited study supports the instrument itself and does not validate the specific historical Chinese-language form used in this study.	The cited psychometric study supports the measurement properties of HAMA generally but does not validate the specific Chinese-language version used in this study.
HAMD-17	Chinese 17-item Hamilton Depression Rating Scale	Face-to-face clinician-rated assessment by one of three trained gastroenterologists	17	0-52	Items scored on 0-4 or 0-2 scales; total score is the sum of item scores	≥8 for HAMD-17-defined depressive symptom status; operational threshold, not a psychiatric diagnosis	Hamilton 1960 [15]	Zheng et al., 1988 [19] - Chinese validation and reliability evidence	The cited Chinese-language study provides psychometric or validation support. Full item-level instrument content is not reproduced because redistribution rights for the specific Chinese-language material used in this study were not established.
PSQI	Chinese Pittsburgh Sleep Quality Index	Physician-administered interview based on patient-reported responses	19 patient-reported items contribute to scoring; additional bed-partner items are not scored	0-21	Seven component scores (0-3 each) are summed; higher scores indicate poorer sleep quality	>7 for poor sleep quality; operational threshold in this study	Buysse et al., 1989 [16]	Yan et al., 2021 [20] - preliminary reliability and validity evidence for a Chinese PSQI version in people living with HIV; Tsai et al., 2005 [21] - additional psychometric evidence	Copyright is held by the University of Pittsburgh; official access information is available from the rights holder. The cited Chinese-language study provides psychometric or validation support. Full item-level instrument content is not reproduced because redistribution rights for the specific Chinese-language material used in this study were not established.
GIQLI	Chinese-language Gastrointestinal Quality of Life Index	Physician-administered interview based on patient-reported responses	36	0-144	Each item scored 0-4; higher total scores indicate better gastrointestinal quality of life	No diagnostic cutoff was used	Eypasch et al., 1995 [17]	Yeung et al., 2006 [22] - Chinese translation/validation	GIQLI © Ernst Eypasch, 1995; distribution information is provided

Instrument	Version used	Administration in the present study	Number of items	Score range	Scoring	Study operational cutoff	Original reference	Psychometric or validation evidence	Access/copyright information
								evidence; Lien et al., 2007 [23] - additional Chinese validation evidence. These studies provide supporting measurement evidence but do not by themselves establish the exact authorized version used at this hospital.	by Mapi Research Trust/ePROVIDE. The cited Chinese-language validation studies provide supporting measurement evidence but do not by themselves establish the exact authorized version used at this hospital. Full item-level instrument content is not reproduced because redistribution rights for the specific Chinese-language material used in this study were not established.

Reference numbers correspond to the main manuscript. The cited studies provide psychometric or validation support for the instruments or language-specific versions described in Supplementary Table S1. Although PSQI and GIQLI are patient-reported instruments, in the present study their items were administered by physicians in interview format and responses were based on patients' self-report. The full item-level instrument content is not reproduced because redistribution rights for the specific Chinese-language materials used in this study were not established. The cited GIQLI validation studies provide supporting measurement evidence but do not by themselves establish the exact authorized version used at this hospital. Official instrument-access information is available from the University of Pittsburgh for PSQI, Mapi Research Trust/ePROVIDE for GIQLI, and the CDISC HAM-A instrument listing. CDISC: Clinical Data Interchange Standards Consortium; GIQLI: Gastrointestinal Quality of Life Index; HAM-A/HAMA: Hamilton Anxiety Rating Scale; HAMD-17: 17-item Hamilton Depression Rating Scale; PSQI: Pittsburgh Sleep Quality Index.

Supplementary Table 2 Functional dyspepsia symptom characteristics by subtype

Characteristic	PDS (n = 98)	EPS (n = 58)	Overlapping (n = 30)	P value
Postprandial fullness	91 (92.9)	26 (44.8)	26 (86.7)	<0.001
Early satiation	83 (84.7)	25 (43.1)	17 (56.7)	<0.001
Epigastric pain	44 (44.9)	52 (89.7)	13 (43.3)	<0.001
Epigastric burning	28 (28.6)	46 (79.3)	22 (73.3)	<0.001
Symptom severity score	7.6 ± 2.5	6.3 ± 2.5	9.6 ± 1.8	<0.001

Values are n (%) or mean ± standard deviation. Overall P values were calculated using Pearson's chi-square test or one-way analysis of variance. EPS: Epigastric pain syndrome; PDS: Postprandial distress syndrome.

Supplementary Table 3 Baseline comparison of included patients and patients excluded because all four rating scales were missing

Characteristic	Included (n = 186)	Excluded: all four scales missing (n = 25)	P value	Absolute SMD
Age, years	43.8 ± 11.6	48.7 ± 12.5	0.072	0.409
Female sex	108 (58.1)	18 (72.0)	0.182	0.295
BMI, kg/m²	23.4 ± 3.3	23.1 ± 3.6	0.630	0.107
Disease duration, years	3.2 ± 3.3	4.0 ± 4.9	0.447	0.187
FD subtype			0.274	
EPS	58 (31.2)	9 (36.0)	NA	0.102
PDS	98 (52.7)	15 (60.0)	NA	0.148
Overlapping	30 (16.1)	1 (4.0)	NA	0.412
Symptom severity score	7.5 ± 2.6	7.4 ± 2.8	0.885	0.032
H. pylori positive	67 (36.0)	12 (48.0)	0.245	0.244
Concomitant IBS	34 (18.3)	3 (12.0)	0.581	0.176
Current smoking	42 (22.6)	3 (12.0)	0.302	0.283
Alcohol consumption	38 (20.4)	4 (16.0)	0.791	0.115
Married	145 (78.0)	20 (80.0)	0.816	0.050
Education ≥ high school	98 (52.7)	13 (52.0)	0.948	0.014

Values are n (%) or mean ± standard deviation. Continuous variables were compared using Welch's t test. Categorical variables were compared using Pearson's chi-square test or Fisher's exact test, as appropriate; the P value for FD subtype is the overall 2 × 3 comparison. SMDs for continuous variables used the difference in means divided by the square root of the average group variances; categorical-level SMDs used the corresponding binary proportions. Conventional P values did not identify statistically significant differences, but the SMDs show potential imbalance and do not exclude selection bias. BMI: Body mass index; EPS: Epigastric pain syndrome; FD: Functional dyspepsia; IBS: Irritable bowel syndrome; PDS: Postprandial distress syndrome; SMD: Standardized mean difference. NA: Not applicable.

Supplementary Table 4 Univariable associations with Hamilton Anxiety Rating Scale-defined anxiety symptom status

Variable	HAMA-positive (n = 79)	HAMA-negative (n = 107)	P value
Female sex	56 (70.9)	52 (48.6)	0.002
Age ≥50 years	27 (34.2)	28 (26.2)	0.237
Disease duration ≥2 years	48 (60.8)	42 (39.3)	0.004
Symptom severity score	8.7 ± 2.2	6.7 ± 2.5	<0.001
Poor sleep quality	45 (57.0)	32 (29.9)	<0.001
Concomitant IBS	22 (27.8)	12 (11.2)	0.004
H. pylori positive	31 (39.2)	36 (33.6)	0.432

Values are n (%) or mean ± standard deviation. P values are from Pearson's chi-square tests or Welch's t test. These descriptive univariable comparisons were not used to screen variables for the multivariable model. HAMA: Hamilton Anxiety Rating Scale; IBS: Irritable bowel syndrome.

Supplementary Table 5 Primary clinically informed multivariable logistic model for Hamilton Anxiety Rating Scale-defined anxiety symptom status

Variable	OR	95% CI	P value
Female sex	2.79	1.32-5.91	0.007
Age (per year)	1.01	0.98-1.04	0.484
Disease duration ≥2 years	3.00	1.44-6.24	0.003
Symptom severity (per point)	1.45	1.22-1.72	<0.001
Poor sleep quality	2.81	1.36-5.81	0.005
Concomitant IBS	2.27	0.88-5.87	0.092
PDS vs EPS	1.63	0.70-3.78	0.254
Overlapping subtype vs EPS	1.57	0.48-5.12	0.451

The primary outcome was HAMA-defined anxiety symptom status. Covariates were selected according to clinical relevance, prior evidence, and potential confounding rather than univariable P values. EPS was the reference category for functional dyspepsia subtype. CI: Confidence interval; EPS: Epigastric pain syndrome; HAMA: Hamilton Anxiety Rating Scale; IBS: Irritable bowel syndrome; OR: Odds ratio; PDS: Postprandial distress syndrome.

Supplementary Table 6 Continuous disease-duration sensitivity model

Variable	OR	95% CI	P value
Female sex	2.69	1.27-5.69	0.010
Age (per year)	1.01	0.98-1.04	0.564
Disease duration (per 1-year increase)	1.19	1.06-1.34	0.003
Symptom severity (per point)	1.52	1.27-1.82	<0.001
Poor sleep quality	2.64	1.28-5.44	0.009
Concomitant IBS	2.13	0.82-5.49	0.119
PDS vs EPS	1.69	0.73-3.92	0.221
Overlapping subtype vs EPS	1.40	0.43-4.50	0.575

The model retained the clinically informed covariate structure used in the primary model, with the specified continuous substitution. EPS was the reference category for functional dyspepsia subtype. CI: Confidence interval; EPS: Epigastric pain syndrome; IBS: Irritable bowel syndrome; OR: Odds ratio; PDS: Postprandial distress syndrome.

Supplementary Table 7 Continuous Pittsburgh Sleep Quality Index sensitivity model

Variable	OR	95% CI	P value
Female sex	2.85	1.34-6.06	0.007
Age (per year)	1.01	0.98-1.04	0.628
Disease duration ≥2 years	3.02	1.44-6.35	0.003
Symptom severity (per point)	1.47	1.23-1.74	<0.001
PSQI (per 1-point increase)	1.12	1.05-1.20	0.001
Concomitant IBS	2.38	0.92-6.17	0.074
PDS vs EPS	1.73	0.74-4.05	0.207
Overlapping subtype vs EPS	1.65	0.50-5.42	0.410

The model retained the clinically informed covariate structure used in the primary model, with the specified continuous substitution. EPS was the reference category for functional dyspepsia subtype. CI: Confidence interval; EPS: Epigastric pain syndrome; IBS: Irritable bowel syndrome; OR: Odds ratio; PDS: Postprandial distress syndrome. PSQI: Pittsburgh Sleep Quality Index.

Supplementary Table 8 Sensitivity model with both disease duration and Pittsburgh Sleep Quality Index entered continuously

Variable	OR	95% CI	P value
Female sex	2.73	1.29-5.80	0.009
Age (per year)	1.01	0.97-1.04	0.723
Disease duration (per 1-year increase)	1.18	1.05-1.33	0.005
Symptom severity (per point)	1.53	1.28-1.83	<0.001
PSQI (per 1-point increase)	1.11	1.04-1.19	0.003
Concomitant IBS	2.25	0.88-5.78	0.092
PDS vs EPS	1.80	0.77-4.21	0.177
Overlapping subtype vs EPS	1.46	0.45-4.74	0.530

The model retained the clinically informed covariate structure used in the primary model, with the specified continuous substitution. EPS was the reference category for functional dyspepsia subtype. CI: Confidence interval; EPS: Epigastric pain syndrome; IBS: Irritable bowel syndrome; OR: Odds ratio; PDS: Postprandial distress syndrome. PSQI: Pittsburgh Sleep Quality Index.

Supplementary Table 9 Full adjusted Gastrointestinal Quality of Life Index models

Variable	Adjusted difference or β	95% CI	P value
Primary adjusted model			
HAMA-defined anxiety symptoms	-21.89	-26.52 to -17.27	<0.001
Age (per year)	-0.04	-0.21 to 0.13	0.653
Female sex	-0.75	-4.92 to 3.42	0.723
Disease duration ≥2 years	3.48	-0.64 to 7.59	0.097
Symptom severity (per point)	0.25	-0.59 to 1.09	0.562
Model R^2	0.373	NA	NA
HAMD-17-adjusted sensitivity model			
HAMA-defined anxiety symptoms	-21.46	-26.29 to -16.64	<0.001
Age (per year)	-0.04	-0.22 to 0.13	0.634
Female sex	-0.76	-4.94 to 3.42	0.720
Disease duration ≥2 years	3.42	-0.70 to 7.55	0.104
Symptom severity (per point)	0.25	-0.59 to 1.09	0.564
HAMD-17 (per point)	-0.08	-0.32 to 0.16	0.529
Model R^2	0.375	NA	NA

The primary model adjusted for age, sex, disease duration ≥2 years, and symptom severity. The sensitivity model additionally adjusted for HAMD-17 score. A negative HAMA-status coefficient indicates a lower adjusted GIQLI score among patients with HAMA-defined anxiety symptoms. CI: Confidence interval; GIQLI: Gastrointestinal Quality of Life Index; HAMA: Hamilton Anxiety Rating Scale; HAMD-17: 17-item Hamilton Depression Rating Scale. NA: Not applicable; R^2: Coefficient of determination; β: Regression coefficient.

Supplementary Table 10 Exploratory cross-sectional path analysis of Pittsburgh Sleep Quality Index, Hamilton Anxiety Rating Scale, and Gastrointestinal Quality of Life Index scores

Path	Statistical association	Standardized β	95% CI / P value
a	PSQI to HAMA	0.214	P = 0.004
b	HAMA to GIQLI, adjusted for PSQI	-0.435	P < 0.001
c	Total PSQI-GIQLI association	-0.243	P < 0.001
c'	Direct PSQI-GIQLI association	-0.150	P = 0.024
a × b	Indirect statistical association through HAMA	-0.093	-0.171 to -0.028
	Statistically decomposed proportion	38.4%	

Models were adjusted for age, sex, continuous disease duration, and functional dyspepsia subtype. The interval for the indirect statistical association used 5000 bootstrap resamples. This exploratory cross-sectional path analysis does not establish temporal ordering, causal mediation, or biological mechanisms. GIQLI: Gastrointestinal Quality of Life Index; HAMA: Hamilton Anxiety Rating Scale; PSQI: Pittsburgh Sleep Quality Index. CI: Confidence interval; β: Standardized regression coefficient.

Supplementary Table 11 Sensitivity analysis after excluding patients with concomitant irritable bowel syndrome

Variable	OR	95% CI	P value
Female sex	3.40	1.40–8.26	0.007
Age (per year)	1.00	0.96–1.04	0.876
Disease duration ≥ 2 years	4.46	1.85–10.76	<0.001
Symptom severity (per point)	1.54	1.25–1.90	<0.001
Poor sleep quality	3.47	1.50–8.02	0.004
PDS vs EPS	1.75	0.65–4.71	0.267
Overlapping subtype vs EPS	1.91	0.47–7.70	0.365

The outcome was Hamilton Anxiety Rating Scale-defined anxiety symptom status. The analysis excluded 34 patients with concomitant irritable bowel syndrome, leaving 152 patients, including 57 with the outcome. The model retained the clinically informed covariate structure of the primary analysis except that the irritable bowel syndrome term was omitted. Epigastric pain syndrome was the reference category for functional dyspepsia subtype. This sensitivity analysis assessed robustness to exclusion of participants with concomitant irritable bowel syndrome and did not establish that IBS-related confounding was eliminated. CI: Confidence interval; EPS: Epigastric pain syndrome; IBS: Irritable bowel syndrome; OR: Odds ratio; PDS: Postprandial distress syndrome.

Supplementary Table 12 Regression diagnostics

Model	Diagnostic domain	Test or criterion	Result	Interpretation
Primary logistic model	Linearity in the logit	Age × ln(age), Box-Tidwell term	P = 0.375	No evidence of nonlinearity in the logit.
Primary logistic model	Linearity in the logit	Symptom severity × ln(symptom severity), Box-Tidwell term	P = 0.599	No evidence of nonlinearity in the logit.
Primary logistic model	Linearity in the logit	Joint likelihood-ratio test	$\chi^2(2) = 1.10$; P = 0.578	No joint evidence of nonlinearity in the logit.
Primary GIQLI linear model	Residual distribution	Shapiro-Wilk test	W = 0.993; P = 0.584	No evidence of departure from residual normality.
Primary GIQLI linear model	Heteroscedasticity	Koenker-Breusch-Pagan test	$\chi^2(5) = 9.67$; P = 0.085	No evidence of heteroscedasticity at P < 0.05.
Primary GIQLI linear model	Linearity	Ramsey RESET test	F(1, 179) = 1.83; P = 0.178	No evidence of functional-form misspecification.
Primary GIQLI linear model	Influence	Cook's distance, leverage, and externally studentized residuals	Maximum Cook's D = 0.055; 4 observations > 4/n (0.0215). Maximum leverage = 0.062; 0 observations > 2p/n (0.0645). Maximum |studentized residual| = 2.82; 0 observations > 3.	Several Cook's-distance screening flags were present, but no observation exceeded the stated leverage or studentized-residual threshold; none was deleted.
HAMD-17-adjusted GIQLI model	Residual distribution	Shapiro-Wilk test	W = 0.993; P = 0.570	No evidence of departure from residual normality.
HAMD-17-adjusted GIQLI model	Heteroscedasticity	Koenker-Breusch-Pagan test	$\chi^2(6) = 15.59$; P = 0.016	Evidence of heteroscedasticity; conventional standard errors should be interpreted cautiously.
HAMD-17-adjusted GIQLI model	Linearity	Ramsey RESET test	F(1, 178) = 1.17; P = 0.281	No evidence of functional-form misspecification.
HAMD-17-adjusted GIQLI model	Influence	Cook's distance, leverage, and externally studentized residuals	Maximum Cook's D = 0.048; 4 observations > 4/n (0.0215). Maximum leverage = 0.108; 5 observations > 2p/n (0.0753). Maximum |studentized residual| = 2.78; 0 observations > 3.	Cook's-distance and leverage screening flags were present, but no observation exceeded |studentized residual| > 3; none was deleted.
Continuous-duration sensitivity model	Pre-transformation range check	Disease duration and PSQI values	Duration: 0.2-20.0 years; 0 zero or negative values. PSQI: 0-18; 12 zero values and 0 negative values.	Box-Tidwell was applicable to duration. Because PSQI included zeros, no constant was added and a natural restricted cubic spline diagnostic was used for PSQI.
Continuous-duration sensitivity model	Linearity in the logit	Disease duration x ln(disease duration), Box-Tidwell term	P = 0.174	No evidence of nonlinearity in the logit.

Model	Diagnostic domain	Test or criterion	Result	Interpretation
Continuous-PSQI sensitivity model	Linearity in the logit	Natural restricted cubic spline (4 df) versus linear PSQI; likelihood-ratio test	chi-square(3) = 1.61; P = 0.656	No evidence of nonlinearity in the logit; no offset or constant was added to PSQI.
Both-continuous sensitivity model	Linearity in the logit	Disease duration x ln(disease duration), Box-Tidwell term	P = 0.143	No evidence of nonlinearity in the logit for disease duration.
Both-continuous sensitivity model	Linearity in the logit	PSQI nonlinear spline components; partial likelihood-ratio test	chi-square(3) = 2.53; P = 0.470	No evidence of nonlinearity in the logit for PSQI; no offset or constant was added.
Both-continuous sensitivity model	Linearity in the logit	Joint likelihood-ratio test of duration Box-Tidwell term and PSQI nonlinear spline components	chi-square(4) = 4.71; P = 0.319	No joint evidence of departure from linearity in the logit.

These diagnostic checks used the same outcomes and covariate specifications as the reported models and were not used to select predictors, delete observations, or alter reported estimates. For Cook's distance, 4/n was used as a screening threshold; for leverage, 2p/n was used, where p includes the intercept. Conventional two-sided P < 0.05 indicated evidence of assumption departure. GIQLI: Gastrointestinal Quality of Life Index; HAMD-17: 17-item Hamilton Depression Rating Scale. These added checks were diagnostic only and did not change the reported sensitivity-model estimates, sample, or covariate structure.

Supplementary Table 13 Variable-level missingness in the analytic cohort

Variable	Available, n	Missing, n (%)	Handling
Age	186	0 (0.0)	None
Sex	186	0 (0.0)	None
BMI	186	0 (0.0)	None
Disease duration	186	0 (0.0)	None
FD subtype	186	0 (0.0)	None
Postprandial fullness	186	0 (0.0)	None
Early satiation	186	0 (0.0)	None
Epigastric pain	186	0 (0.0)	None
Epigastric burning	186	0 (0.0)	None
Symptom severity score	186	0 (0.0)	None
H. pylori status	186	0 (0.0)	None
Concomitant IBS	186	0 (0.0)	None
Smoking	186	0 (0.0)	None
Alcohol consumption	186	0 (0.0)	None
Marital status	186	0 (0.0)	None
Education	186	0 (0.0)	None
HAMA score	186	0 (0.0)	None
HAMA-defined anxiety status	186	0 (0.0)	None
HAMD-17 score	186	0 (0.0)	None
HAMD-17-defined depressive status	186	0 (0.0)	None
PSQI score	186	0 (0.0)	None
Poor-sleep status	186	0 (0.0)	None
GIQLI score	186	0 (0.0)	None