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Risk Factors of Functional Dyspepsia, Gastrointestinal Reflux Disease and Non-Erosive Reflux Disease

Ayesha Malik,[1] Rafi Ud Din,[1] Mahrosh Asif,[2] Iqra Naeem,[3] Aamir Habib,[1] Asma Arshad Khan[1]

1. Department of Gastroenterology Combined Military Hospital, Lahore, Pakistan.
2. Department of Medicine Combined Military Hospital, Lahore, Pakistan.
3. Department of Medicine, Tehsil Headquarters, Chichawatni, Pakistan.

Corresponding author:
AYESHA MALIK
E: aym85@yahoo.com
T: 03444348485

Abstract

Background/Aim: Functional dyspepsia, erosive and non-erosive gastroesophageal reflux disease (GERD) present a major health burden, adversely effecting quality of life. A range of factors are hypothesised to have a positive and negative influence on these diseases. This study aimed to explore the risk factors of functional dyspepsia, gastrointestinal reflux disease and non-erosive reflux disease and its subgroups.

Methods: A cross-sectional study was conducted at Combined Military Hospital (CMH), Lahore, Pakistan, from January to June 2024. Two hundred and twenty-two patients were included and interviewed to fill a tri-section questionnaire comprising a self-designed comprehensive health survey, food frequency questionnaire, gastroesophageal reflux disease questionnaire (GERD-Q), Rome IV criteria and hospital anxiety and depression scale (HADS).

Results: Participants consisted of 70 controls, 38 GERD, 24 non-erosive reflux disease, 56 functional dyspepsia and 24 overlap reflux-dyspepsia syndrome patients. Subgroups included symptomatic and asymptomatic erosive oesophagitis, epigastric pain syndrome, postprandial distress syndrome and overlap syndrome. Older age, higher body mass index (BMI), male gender, low vegetable and yogurt intake, smoking, frequent red meat, high tea/caffeine intake, no postprandial exercise and a short dinner sleep interval were risk factors for GERD and symptomatic erosive esophagitis. Low BMI, female gender and anxiety were strongly associated with functional dyspepsia and non-erosive reflux disease.

Conclusion: Age, BMI, gender, tobacco, anxiety, depression, dietary habits and food frequencies are significant risk factors of dyspepsia and reflux disease.

Key words: Anxiety; Depression; Dyspepsia; Gastroesophageal reflux; Risk factors.

Introduction

Patients presenting with upper gastrointestinal (GI) symptoms account for the bulk of outdoor referrals in gastroenterology clinics. These symptoms commonly include epigastric pain, nausea, belching, early satiety, retrosternal burning, reflux and vomiting- which were previously grouped under an umbrella term 'dyspepsia'. Dyspepsia occurs from organic or functional causes. American College of Gastroenterology guidelines define dyspepsia as predominant epigastric pain lasting at least 1 month.[1] The Rome IV criteria is used to diagnose functional dyspepsia (FD), which lacks gross abnormalities on upper GI endoscopy.[2] The criteria also classify FD

into subclasses: epigastric pain syndrome (EPS) and post prandial distress syndrome (PPDS). Another subclass, overlap syndrome (OLS), refers to the co-occurrence of FD with other functional GI disorders.

GERD is the most common cause of non-cardiac chest pain.[3] Many patients with typical GERD symptoms may have normal upper GI endoscopies, a condition known as non-erosive reflux disease (NERD). Patients with oesophageal erosions or ulcers are diagnosed as erosive oesophagitis (EE), according to the Los Angeles classification.[4] Erosive oesophagitis can be asymptomatic or symptomatic and both types indicate GERD. Asymptomatic cases usually warrant further eval-

uation as it complicates diagnosis and management.

Previous studies report that various factors such as gender, age, weight and psychosocial parameters increase the risk of FD.[5] In some studies, psychological disorders have also shown to affect symptoms of reflux. Very few studies have simultaneously studied both FD and GERD. Fewer still, have studied the association of specific risk factors with each disease in depth. This study aimed to identify various demographic and psychosocial parameters that have an impact on each disorder in order to help improve treatment outcomes.

Methods

A cross-sectional study was conducted from January to June 2024 by CMH Lahore Gastroenterology Department. After ethical review committee approval, all consecutive patients undergoing EGD for any indication, above 18 years old and

willing to participate were included. Patients with pre-existing cardiovascular, renal, hepatic or psychological disorders, pregnant subjects, those with gross abnormalities on EGD e.g; gastric erythema, gastro-duodenal ulcers, tumours
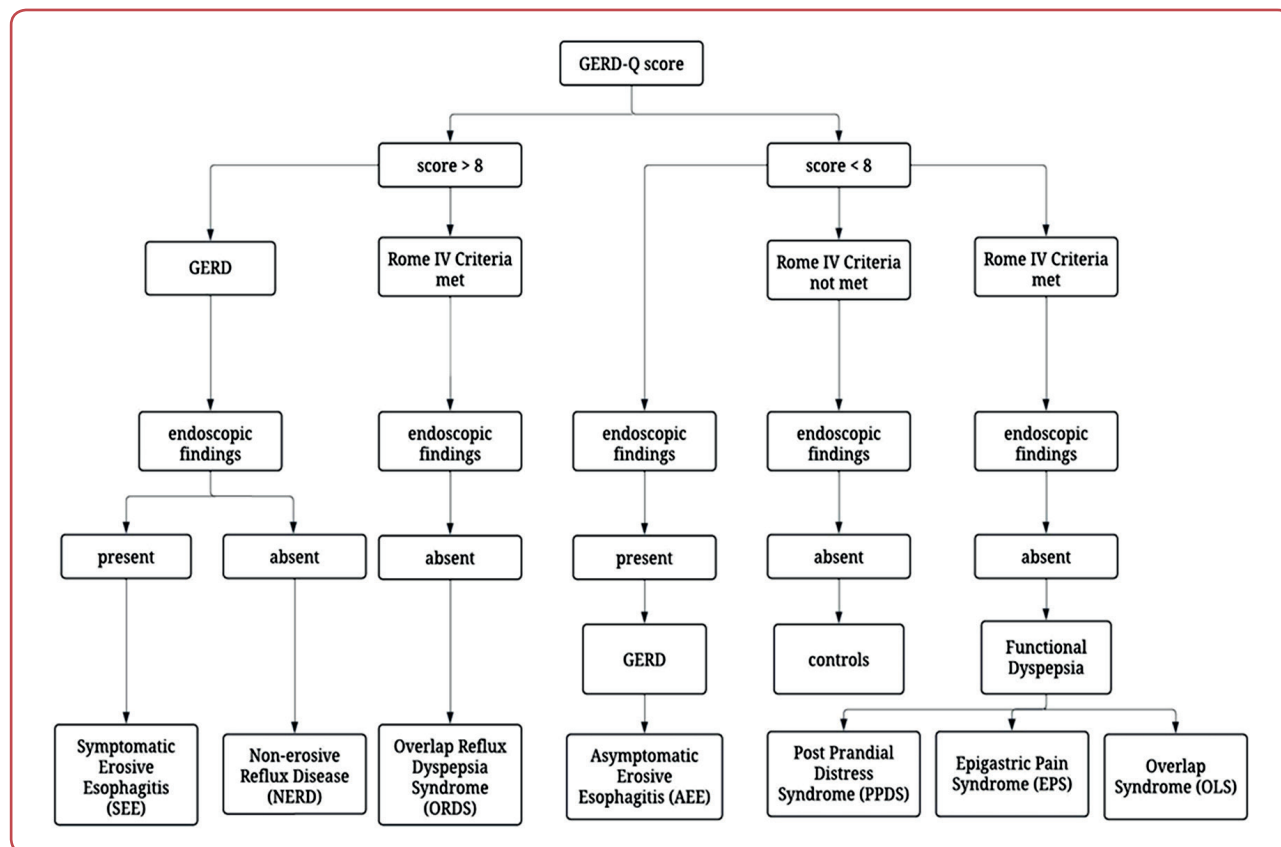

Figure 1: Patient groups and subgroups

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or those with history of upper GI surgery or GI bleed were excluded.

After informed consent, patients were interviewed by one designated researcher. A tri-section questionnaire was used - section 1: self-designed comprehensive health survey and food frequency questionnaire; section 2: gastroesophageal reflux disease questionnaire (GERD-Q) and Rome IV criteria; and section 3: hospital anxiety and depression scale (HADS). Sociodemographic data, medical history, specific health metrics were recorded. EGDs were performed by two designated endoscopists.

Patient groups and subgroups were classified according to questionnaire scores and EGD findings (Figure 1). Presence of oesophageal erosions or ulcers on endoscopy were interpreted as positive findings. A GERD-Q score > 8 suggests symptomatic GERD while scores < 8 indicate no significant GERD symptoms. GERD was diagnosed based on either GERD-Q score > 8 or positive EGD finding. Overlap reflux dyspepsia syndrome (ORDS) was labelled for co-occurrence of NERD and FD.

Data were analysed using SPSS version 26. Continuous variables were expressed as means ± standard deviation (SD). Categorical data was presented as frequencies and percentages. Chi square test and independent samples t-test were used to compare variables. Logistic regression and odds ratios (OR) with 95 % confidence intervals were used for multivariate analysis. P-value < 0.05 was statistically significant.

Results

Total of 298 patients were recruited; 222 met the inclusion criteria and 76 were excluded. There were 118 (53.25 %) males and 104 (46.8 %) females. The mean age and mean BMI of the sample was 37.15 ± 10.70 years and 23.85 ± 4.12, respectively. The variables and distribution of groups and subgroups is summarised in Table 1-3.

Table 1: Demographic data of participants in different groups of GERD, FD, NERD, ORDS

Variables		Control	GERD			FD				NERD	ORDS
			Total	SEE	AEE	Total	EPS	PPDS	OLS		
N (%)		70 (31.50 %)	38 (17.10 %)	26 (11.70 %)	12 (5.40 %)	56 (25.20 %)	14 (6.30 %)	14 (6.30 %)	28 (12.60 %)	24 (10.80 %)	34 (15.30 %)
Mean age (years)		34.43 ± 11.58 p = 0.010	40.82 ± 9.47 p = 0.023	38.47 ± 6.49 p = 0.504	45.92 ± 12.83 p = 0.103	36.66 ± 8.62 p = 0.693	42.14 ± 6.09 p = 0.072	37.40 ± 5.84 p = 0.929	33.55± 9.55 p = 0.057	41.35 ± 11.33 p = 0.045	36.49 ± 11.31 p = 0.699
Mean BMI (kg/m²)		24.34 ± 3.85 p = 0.235	23.83 ± 4.09 p = 0.980	24.94 ± 3.63 p = 0.152	21.44 ± 4.14 p = 0.137	23.71 ± 4.79 p = 0.772	25.89 ± 4.49 p = 0.008	24.87 ± 3.80 p = 0.344	22.06 ± 4.91 p = 0.113	25.89 ± 2.80 p = 0.010	21.66 ± 3.45 p = 0.001
Gender											
	Male	28 (40.00 %)	34 (89.50 %)	24 (92.30 %)	10 (83.30 %)	34 (60.7 %)	12 (85.7 %)	6 (42.9 %)	16 (57.1 %)	10 (41.7 %)	12 (35.30 %)
	Female	42 (60.00 %)	4 (10.50 %)	2 (7.70 %)	2 (16.70 %)	22 (39.3 %)	2 (14.3 %)	8 (57.1 %)	12 (42.9 %)	14 (58.3 %)	22 (64.70 %)
		p = 0.118	p = 0.000	p = 0.000	p = 0.051	p = 0.190	p = 0.051	p = 0.425	p = 0.651	p = 0.032	p = 0.023
Occupation											
	Active	52 (74.30 %)	28 (73.60 %)	20 (76.90 %)	8 (66.70 %)	34 (60.70 %)	8 (57.10 %)	8 (57.10 %)	18 (64.30 %)	10 (41.70 %)	18 (52.90 %)
	Sedentary	18 (25.70 %)	10 (26.30 %)	6 (23.10 %)	4 (33.30 %)	22 (39.30 %)	6 (42.90 %)	6 (42.90 %)	10 (35.70 %)	14 (58.30 %)	16 (47.10 %)
		p = 0.053	p = 0.170	p = 0.143	p = 0.841	p = 0.558	p = 0.583	p = 0.583	p = 0.970	p = 0.056	p = 0.146
Tobacco (pack years)											
	≤ 10	2 (2.90 %)	12 (31.50 %)	8 (30.80 %)	4 (33.30 %)	10 (17.90 %)	2 (14.30 %)	0 (0.00 %)	8 (28.60 %)	2 (8.30 %)	2 (5.90 %)
	> 10	6 (8.90 %)	6 (15.70 %)	0 (0.00 %)	6 (50.00 %)	4 (7.10 %)	2 (14.30 %)	0 (0.00 %)	2 (7.10 %)	0 (0.00 %)	0 (0.00 %)
		p = 0.052	p = 0.000	p = 0.006	p = 0.000	p = 0.393	p = 0.548	p = 0.159	p = 0.053	p = 0.253	p = 0.071
Comorbidity											
	Diabetes	4 (5.70 %) p = 0.245	6 (15.70 %) p = 0.109	2 (7.70 %) p = 0.803	4 (33.30 %) p = 0.052	8 (14.20 %) p = 0.111	0 (0.00 %) p = 0.224	6 (42.90 %) p = 0.050	2 (7.10 %) p = 0.712	0 (0.00 %) p = 0.103	2 (5.90 %) p = 0.489
	Hypertension	8 (11.40 %) p = 0.050	10 (26.30 %) p = 0.350	8 (30.80 %) p = 0.178	2 (16.70 %) p = 0.722	12 (21.40 %) p = 0.880	6 (42.90 %) p = 0.055	0 (0.00 %) p = 0.058	6 (21.40 %) p = 0.921	6 (25.00 %) p = 0.584	10 (29.40 %) p = 0.174
	Asthma	0 (0.00 %) p = 0.171	2 (5.50 %) p = 0.078	0 (0.00 %) p = 0.462	2 (16.70 %) p = 0.100	0 (0.00 %) p = 0.241	0 (0.00 %) p = 0.601	0 (0.00 %) p = 0.601	0 (0.00 %) p = 0.443	2 (8.30 %) p = 0.111	0 (0.00 %) p = 0.391
	Anxiety	30 (42.80 %) p = 0.937	12 (31.50 %) p = 0.111	10 (38.50 %) p = 0.600	2 (16.70 %) p = 0.056	20 (35.70 %) p = 0.188	2 (14.30 %) p = 0.024	6 (42.90 %) p = 0.976	12 (42.9 %) p = 0.965	12 (50.00 %) p = 0.049	22 (64.70 %) p = 0.018
	Depression	20 (28.60 %) p = 0.053	24 (63.20 %) p = 0.006	15 (57.60 %) p = 0.013	9 (75.00 %) p = 0.052	26 (46.40 %) p = 0.578	8 (57.10 %) p = 0.278	9 (64.20 %) p = 0.001	9 (32.10 %) p = 0.205	12 (50.00 %) p = 0.479	14 (41.20 %) p = 0.792

*p-value < 0.05 was statistically significant
** GERD: Gastroesophageal reflux disease, SEE: symptomatic erosive oesophagitis, AEE: asymptomatic erosive oesophagitis, FD: functional dyspepsia, EPS: epigastric pain syndrome, PPDS: postprandial distress syndrome, OLS: overlap syndrome NERD: non-erosive reflux disease, ORDS: overlap-reflux dyspepsia syndrome;

Table 2: Medications of participants in different groups of GERD, FD, NERD, ORDS

Medications	Control	GERD Total	GERD SEE	GERD AEE	FD Total	FD EPS	FD PPDS	FD OLS	NERD	ORDS
N (%)	70 (31.5 %)	38 (17.1 %)	26 (11.7 %)	12 (5.4 %)	56 (25.2 %)	14 (6.3 %)	14 (6.3 %)	28 (12.6 %)	24 (10.8 %)	34 (15.3 %)
CCBs	4 (5.7 %) $p = 0.890$	2 (5.3 %) $p = 0.966$	0 (0.0 %) $p = 0.195$	2 (16.7 %) $p = 0.076$	4 (7.1 %) $p = 0.506$	2 (14.2 %) $p = 0.129$	0 (0.0 %) $p = 0.355$	2 (7.1 %) $p = 0.664$	0 (0.0 %) $p = 0.215$	2 (5.9 %) $p = 0.894$
Beta blockers	0 (0.0 %) $p = 0.051$	0 (0.0 %) $p = 0.190$	0 (0.0 %) $p = 0.294$	0 (0.0 %) $p = 0.491$	4 (7.1 %) $p = 0.100$	2 (14.2 %) $p = 0.057$	2 (14.2 %) $p = 0.067$	0 (0.0 %) $p = 0.274$	2 (8.3 %) $p = 0.188$	2 (5.9 %) $p = 0.439$
NSAIDs	0 (0.0 %) $p = 0.051$	2 (5.3 %) $p = 0.376$	2 (7.7 %) $p = 0.803$	0 (0.0 %) $p = 0.262$	8 (14.3 %) $p = 0.111$	0 (0.0 %) $p = 0.224$	2 (14.3 %) $p = 0.476$	6 (21.4 %) $p = 0.054$	6 (25.0 %) $p = 0.064$	4 (11.8 %) $p = 0.542$
Antiplatelet	2 (2.9 %) $p = 0.422$	0 (0.0 %) $p = 0.141$	0 (0.0 %) $p = 0.239$	0 (0.0 %) $p = 0.439$	6 (10.7 %) $p = 0.110$	2 (14.3 %) $p = 0.068$	4 (28.6 %) $p = 0.100$	0 (0.0 %) $p = 0.219$	0 (0.0 %) $p = 0.260$	2 (5.9 %) $p = 0.674$
Supplements	12 (17.1 %) $p = 0.059$	2 (5.3 %) $p = 0.226$	0 (0.0 %) $p = 0.059$	2 (16.7 %) $p = 0.502$	8 (14.3 %) $p = 0.333$	0 (0.0 %) $p = 0.178$	4 (28.6 %) $p = 0.127$	4 (14.3 %) $p = 0.526$	2 (8.3 %) $p = 0.679$	0 (0.0 %) $p = 0.804$
Steroids	0 (0.0 %) $p = 0.092$	2 (5.3 %) $p = 0.285$	0 (0.0 %) $p = 0.366$	2 (16.7 %) $p = 0.052$	0 (0.0 %) $p = 0.149$	0 (0.0 %) $p = 0.519$	0 (0.0 %) $p = 0.519$	0 (0.0 %) $p = 0.345$	2 (8.3 %) $p = 0.072$	2 (5.9 %) $p = 0.214$

*p-value < 0.05 was statistically significant
** GERD: Gastroesophageal reflux disease, SEE: symptomatic erosive oesophagitis, AEE: asymptomatic erosive oesophagitis, FD: functional dyspepsia, EPS: epigastric pain syndrome, PPDS: postprandial distress syndrome, OLS: overlap syndrome NERD: non-erosive reflux disease, ORDS: overlap-reflux dyspepsia syndrome, CCBs: calcium channel blockers, NSAIDs: non-steroidal anti-inflammatory drugs;

Table 3: Dietary habits of participants in different groups of GERD, FD, NERD, ORDS

Variables	Control	GERD Total	GERD SEE	GERD AEE	FD Total	FD EPS	FD PPDS	FD OLS	NERD	ORDS
N (%)	70 (31.5 %)	38 (17.1 %)	26 (11.7 %)	12 (5.4 %)	56 (25.2 %)	14 (6.3 %)	14 (6.3 %)	28 (12.6 %)	24 (10.8 %)	34 (15.3 %)
Dietary habits										
Short dinner-sleep interval (< 2 h)	14 (20.0 %) $p = 0.000$	16 (42.1 %) $p = 0.974$	12 (46.2 %) $p = 0.055$	4 (33.3 %) $p = 0.516$	34 (60.7 %) $p = 0.051$	12 (85.7 %) $p = 0.001$	4 (28.6 %) $p = 0.281$	18 (64.3 %) $p = 0.052$	12 (50.0 %) $p = 0.421$	18 (52.9 %) $p = 0.174$
Skipping breakfast	22 (31.4 %) $p = 0.432$	16 (42.1 %) $p = 0.323$	8 (30.8 %) $p = 0.620$	8 (66.7 %) $p = 0.051$	28 (50.0 %) $p = 0.019$	8 (57.1 %) $p = 0.035$	4 (28.6 %) $p = 0.595$	16 (57.1 %) $p = 0.039$	4 (16.7 %) $p = 0.055$	8 (23.6 %) $p = 0.123$
Eating quickly	22 (31.4 %) $p = 0.562$	10 (26.3 %) $p = 0.707$	6 (23.1 %) $p = 0.491$	4 (33.3 %) $p = 0.723$	20 (35.7 %) $p = 0.188$	4 (28.6 %) $p = 0.982$	8 (57.1 %) $p = 0.056$	8 (28.6 %) $p = 0.974$	6 (25.0 %) $p = 0.661$	6 (17.6 %) $p = 0.118$
Post prandial exercise (light-moderate)	14 (20.0 %) $p = 0.051$	10 (26.3 %) $p = 0.613$	6 (23.1 %) $p = 0.039$	4 (33.3 %) $p = 0.049$	14 (25.0 %) $p = 0.221$	2 (14.2 %) $p = 0.042$	4 (28.6 %) $p = 0.042$	8 (28.6 %) $p = 0.046$	12 (50.0 %) $p = 0.051$	16 (47.1 %) $p = 0.056$
Food frequency										
Heavy tea intake (> 2 cups/d)	26 (37.1 %) $p = 0.052$	26 (68.4 %) $p = 0.005$	20 (76.9 %) $p = 0.002$	6 (50.0 %) $p = 0.872$	28 (50.0 %) $p = 0.696$	6 (42.9 %) $p = 0.705$	4 (28.6 %) $p = 0.138$	18 (64.3 %) $p = 0.061$	8 (33.3 %) $p = 0.134$	18 (52.9 %) $p = 0.510$
Low vegetable intake (< 1 serving/d)	52 (74.3 %) $p = 0.050$	18 (47.4 %) $p = 0.768$	13 (50.0 %) $p = 0.012$	5 (41.7 %) $p = 0.974$	22 (39.3 %) $p = 0.076$	6 (42.9 %) $p = 0.605$	6 (42.9 %) $p = 0.605$	10 (35.7 %) $p = 0.117$	8 (33.3 %) $p = 0.092$	10 (29.4 %) $p = 0.051$
High red meat intake (> 2 serving/w)	16 (22.9 %) $p = 0.050$	19 (50.0 %) $p = 0.002$	11 (42.3 %) $p = 0.112$	8 (66.7 %) $p = 0.012$	30 (53.6 %) $p = 0.810$	8 (57.1 %) $p = 0.865$	6 (42.9 %) $p = 0.347$	16 (57.1 %) $p = 0.003$	12 (50.0 %) $p = 0.001$	10 (29.4 %) $p = 0.054$
High citrus fruit intake (≥ 1 serving/d)	10 (14.3 %) $p = 0.062$	2 (5.3 %) $p = 0.376$	2 (7.7 %) $p = 0.103$	0 (0.0 %) $p = 0.262$	0 (0.0 %) $p = 0.056$	0 (0.0 %) $p = 0.224$	0 (0.0 %) $p = 0.224$	0 (0.0 %) $p = 0.075$	6 (2.5 %) $p = 0.054$	2 (5.9 %) $p = 0.689$
High fast-food intake (> 2 serving/w)	26 (37.1 %) $p = 0.100$	2 (5.2 %) $p = 0.133$	0 (0.0 %) $p = 0.214$	2 (16.7 %) $p = 0.966$	8 (14.3 %) $p = 0.515$	4 (28.6 %) $p = 0.240$	2 (14.3 %) $p = 0.771$	2 (7.1 %) $p = 0.134$	2 (9.0 %) $p = 0.226$	0 (0.0 %) $p = 0.104$
Low yogurt intake (< 3 serving/m)	22 (31.4 %) $p = 0.056$	24 (63.2 %) $p = 0.006$	20 (76.9 %) $p = 0.000$	4 (33.3 %) $p = 0.476$	30 (53.5 %) $p = 0.071$	10 (71.4 %) $p = 0.028$	10 (71.4 %) $p = 0.028$	10 (35.7 %) $p = 0.390$	8 (33.3 %) $p = 0.299$	12 (35.3 %) $p = 0.309$

*p-value < 0.05 was statistically significant
** GERD: Gastroesophageal reflux disease, SEE: symptomatic erosive oesophagitis, AEE: asymptomatic erosive oesophagitis, FD: functional dyspepsia, EPS: epigastric pain syndrome, PPDS: postprandial distress syndrome, OLS: overlap syndrome NERD: non-erosive reflux disease, ORDS: overlap-reflux dyspepsia syndrome; day, w: week, m: month;

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Patients were significantly older in GERD (40.82 ± 9.47, p = 0.023) and NERD groups (41.35 ± 11.33, p = 0.045) while controls were significantly younger (34.43 ± 11.58, p = 0.010). Mean BMI was significantly higher in NERD (p = 0.010) and EPS group (p = 0.008) and significantly lower in ORDS group (p = 0.001). Twenty-six (37.1 %) patients of control group, 14 (36.7 %) of GERD, 20 (35.7 %) FD, 12 (50.0 %) NERD and 4 (11.8 %) of ORDS group were overweight (BMI > 25 kg/m^2). Male gender was significantly dominant in the GERD group (p = 0.000, OR = 2.60), particularly in the SEE subgroup (p = 0.000, OR = 8.11), while females showed a significantly higher proportion in the NERD (p = 0.032, OR = 2.10) and ORDS (p = 0.023, OR = 2.75) groups.

Occupation was not significant. Tobacco usage was significantly associated with GERD (p = 0.000, OR = 6.98); patients with < 10 pack years were more likely to have SEE (p = 0.006, OR = 3.45) while those with > 10 pack years were more likely to have AEE (p = 0.000, OR = 3.87).

Of the total sample, 34 (15.3 %) patients had diabetes, 68 (27.0 %) had hypertension, 6 (2.7 %) had asthma, 128 (57.8 %) had anxiety and 146 (65.8 %) had depression. There was no significant association with comorbid diabetes, asthma or hypertension. ORDS and NERD patients had significantly more anxiety, (p = 0.049, OR = 1.33) and (p = 0.018, OR = 2.44), respectively. GERD, particularly SEE, and PPDS had a strong association with comorbid depression, (p = 0.006, OR = 4.29), (p = 0.013, OR = 4.33) and (p = 0.001, OR = 4.55), respectively. Medications were not a significant factor (Table 2).

A lack of short dinner-sleep interval was strongly evident in the control group, (p = 0.000) (Table 3). EPS patients had a significant association with short dinner-sleep interval, (p = 0.001). FD, EPS and OLS patients had a significant majority that skipped breakfast, (p = 0.019, OR = 2.18), (p = 0.035, OR = 2.18) and (p = 0.039, OR = 3.91), respectively. Eating quickly was not a significant factor. AEE, SEE, EPS, PPDS and OLS was notably less often diagnosed in patients who did postprandial exercise, (p = 0.039), (p = 0.049) (p = 0.042), (p = 0.042) and (p = 0.046), respectively.

Heavy tea intake was strongly associated with GERD, particularly SEE (p = 0.005, OR = 3.67) and (p = 0.002, OR = 5.64), respectively. SEE patients were more likely to have a low vegetable intake (p = 0.012). High red meat intake was significant for GERD (p = 0.002), particularly AEE subgroup (p = 0.012, OR = 6.75), OLS (p = 0.003, OR = 4.50) and NERD (p = 0.001, OR = 3.38). High citrus fruit intake was not statistically significant. GERD, SEE, EPS and PPDS was more common among patients with low yogurt intake, (p = 0.006), (p = 0.000, OR = 7.31), (p = 0.028) and (p = 0.028), respectively.

Discussion

GERD, NERD and FD are common upper GI disorders with possible overlapping pathogenesis.[6] Unique combinations of modifiable and non-modifiable risk factors for each condition were identified to help improve patients' quality of life.

Aging slows gastric motility and diminishes gastroesophageal (GE) junction tone, causing increased reflux.[7] Higher BMI and obesity promotes oesophageal inflammation and increases intra-gastric pressures, damaging the GE junction.[8,9] While, lower BMI is associated with functional GI disorders.[10] Presented findings reinforced that older age and higher BMIs are prominent risk factors for GERD and NERD, while lower BMIs are associated with ORDS- a subset of functional GI disorders. Surprisingly, FD had no significant association with BMI and EPS was associated with higher BMIs. Further large-scale studies are required to investigate the link between BMI and FD which may be gender dependent.[11]

Oestrogen benefits women by enhancing the protection of the oesophageal epithelium against gastric acid, leaving men more prone to erosive reflux disease.[12] Despite oestrogen's benefits, women experience FD more frequently.[13] It was found that females were more likely to have ORDS and NERD, while males were more likely to have GERD, primarily SEE.

Food intake and dietary habits significantly impact both functional and reflux disorders.[14, 15] Lack of post prandial exercise and short-dinner sleep intervals reflect sedentary lifestyles. SEE, AEE, EPS, PPDS and OLS were more frequent in sedentary patients. Skipping breakfast has been linked to FD, particularly PPDS and EPS subgroups.[16] Presented findings support this, rather strongly with OLS subgroup.

Diabetic gastroparesis increases risk of GERD and FD.[17] However, in this study diabetes or hypertension, asthma and medications were not found to be significantly associated, owing to the relatively small participant population. These factors are understudied. Large-scale research is required to better understand their role. Anxiety and depression are also well-known risk factors.[18] Worsening GERD correlates with severe anxiety and depression.[19, 20] In presented sample, anxiety was positively correlated with NERD and ORDS while depression was associated with GERD, SEE and PPDS.

Mediterranean diets lower the incidence of GERD and dyspepsia.[21, 22] Presented results were in favour as well. Frequent red meat and caffeine intake, low probiotic yogurt and vegetable (fibre) intake was more likely in GERD, FD and their subgroups. Although smoking is inconsistently reported to correlate with GERD and FD, in this study tobacco strongly correlated with GERD, both SEE and AEE.[5, 23]

Due to the cross-sectional study design temporal relations could not be determined. The results lack generalisability as the sample was taken from a single centre. Further large-scale multicentre studies are required to support these findings.

Conclusion

> Age, BMI, gender, tobacco, anxiety, depression, dietary habits and food frequencies are important risk factors of GERD and FD. Weight control, balanced diet, light exercise, quitting smoking, treating anxiety and depression and improving dietary habits can aid treatment of upper GI disorders.

Ethics

Study was approved by the local Ethics Committee: Research and Review Board at the Combined Military Hospital, Lahore, Decision No 492/2023 dated 23 November 2023.

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Conflicts of interest

The authors declare that there is no conflict of interest.

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Data access

The data that support the findings of this study are available from the corresponding author upon reasonable individual request.

Author ORCID numbers

Ayesha Malik (AM):
0009-0001-4564-4200
Rafi Ud Din (RuD):
0009-0005-3306-3109
Mahrosh Asif (MA):
0000-0001-8960-9565
Iqra Naeem (IN):
0009-0008-4139-9114
Aamir Habib (AH):
0009-0004-6527-9871
Asma Arshad Khan (AAK):
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Author contributions

Conceptualisation: AM, MA
Methodology: AM, MA, RuD
Software: IN

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Formal analysis: AM, MA, IN, AH
Investigation: AM, MA, AAK
Data curation: AM, MA, RuD
Writing - original draft: AM, MA, RuD, IN, AH, AAK
Writing - review and editing: AM, MA, RuD, IN, AH, AAK
Visualisation: AM
Supervision: AM, RuD
Project administration: AM

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