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To Study the Prevalence of Asthma in Patients of Gastroesophageal Reflux Disease in Tertiary Care Centre in Western U.P.

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Abstract

Background: Gastroesophageal reflux disease (GERD) is a prevalent gastrointestinal disorder with significant extra-esophageal manifestations, notably asthma. The association is complex and bidirectional. Indian data, particularly from Western Uttar Pradesh, remain limited. ***Objectives:*** To determine the prevalence and severity of asthma in GERD patients and evaluate their demographic, clinical, and lifestyle profile. ***Methods:*** A cross-sectional study was conducted over 18 months at LLRM Medical College, Meerut. Fifty-eight GERD patients (≥15 years) underwent clinical evaluation, pulmonary function tests (PFTs), and upper GI endoscopy. Demographics, dietary/lifestyle factors, comorbidities, and laboratory parameters were assessed. Statistical analysis was performed using chi-square and t-tests; $p<0.05$ was considered significant. ***Results:*** The mean age was 38.2±13.2 years; males (62.1%) predominated. GERD severity distribution: mild (62.1%), moderate (25.9%), severe (12.1%). Asthma prevalence was 65.5% (mild 27.6%, moderate 22.4%, severe 15.5%). A strong positive correlation was observed between GERD and asthma severity ($p<0.05$). Lifestyle risk factors included spicy food intake (60.3%), late bedtime (<2 hrs post-dinner, 69%), non-vegetarian diet (58.6%), sedentary lifestyle. (46.6%), and smoking (32.8%). Hypertension (25.9%) and diabetes (10.3%) were the most frequent comorbidities. PFTs revealed a progressive decline in FEV_1 with increasing GERD severity. ***Conclusion:*** Asthma is common in GERD patients, with a significant correlation between the severities of both conditions. Early screening and integrated management strategies, including lifestyle modification, are essential to improve outcomes.

Keywords: Gastroesophageal reflux disease, Asthma, Pulmonary function, Lifestyle risk factors, Endoscopy.

INTRODUCTION

Gastroesophageal reflux disease (GERD) is a chronic condition caused by the retrograde flow of gastric contents into the esophagus, resulting in troublesome symptoms such as heartburn and regurgitation. Globally, GERD prevalence varies by geography, ranging from 18–27% in North America, 8–25% in Europe, and 2.5–7.8% in East Asia. Indian studies report prevalence between 10–20%, with risk factors including dietary habits, sedentary lifestyle, obesity, smoking, and alcohol use [1].

Beyond classical esophageal symptoms, GERD is strongly linked with extra-esophageal manifestations including laryngitis, chronic cough, dental erosions, and bronchial asthma. The GERD–asthma association is well recognized, with reported GERD prevalence of 30–50% among asthmatics and asthma prevalence of ~5% among GERD patients. Proposed mechanisms include:

1) Reflux theory: Micro-aspiration of gastric acid/enzymes into the airway, causing bronchospasm and inflammation.
2) Reflex theory: Vagal-mediated reflex bronchoconstriction triggered by esophageal acid exposure.
3) Asthma-induced GERD: Elevated intrathoracic pressure during asthma exacerbations and asthma medications (β-agonists, theophylline, corticosteroids) reducing lower esophageal sphincter (LES) tone.

Western Uttar Pradesh, characterized by high population density, air pollution, smoking prevalence, and unhealthy dietary practices, may have a higher burden of GERD and asthma. However, regional data on asthma prevalence among GERD patients are scarce.

This study aimed to assess the prevalence, severity, and clinical profile of asthma in GERD patients in a tertiary care setting in Western Uttar Pradesh.

MATERIALS AND METHODS

Study Design and Setting

Hospital-based cross-sectional study conducted over 18 months (2022–2023) at the Department of Medicine, LLRM Medical College, Meerut.

Study Population

58 consecutive patients (≥15 years) with clinically and endoscopically diagnosed GERD.

Inclusion Criteria:

1. Age ≥15 years
2. GERD diagnosed (endoscopically)

Exclusion Criteria:

1. Trauma patients
2. Patients on ventilatory support
3. Known bleeding disorder

Clinical Evaluation:

1. Demographic data (age, sex, residence, occupation, education)
2. Lifestyle factors (smoking, diet, physical activity, bedtime habits)
3. Comorbidities (HTN, DM, CAD, hypothyroidism)
4. Symptom profile: heartburn, regurgitation, chest pain, cough, wheezing

Investigations:

1. Hematology: CBC, ESR, AEC
2. Biochemistry: RBS, LFT, KFT, Lipid profile, electrolytes
3. Imaging: Chest X-ray; HRCT thorax as required
4. Pulmonary function tests (spirometry): FEV_1 post-bronchodilator (severity classified as per GOLD criteria)
5. Upper GI endoscopy: GERD severity graded A–D (Los Angeles classification) Statistical Analysis:
6. Descriptive statistics: mean±SD for continuous variables, proportions for categorical variables
7. Inferential statistics: Chi-square test (categorical), t-test (continuous)
8. Software: SPSS v26
9. $p<0.05$ considered statistically significant

RESULTS

Demographic Profile

1. Mean age: 38.2±13.2 years (range 16–63).
2. Majority in 36–45 years (29.3%) age group.
3. Males: 62.1% (n=36); females: 37.9% (n=22).
4. Urban: 58.6%; Rural: 41.4%.

Table 1: Distribution of studied patients based on GERD severity

GERD	Frequency (n=58)	Percentage
Mild	36	62.1%
Moderate	15	25.9%
Severe	7	12.1%

This study included 58 patients, of whom majority of patients, comprising 62.1% (n=36) of the study population, were classified as having mild GERD, indicating that they experienced relatively minor symptoms of acid reflux and heartburn.

In contrast, 25.9% (n=15) of patients had moderate GERD, suggesting that they experienced more frequent and severe symptoms that impacted their daily lives.

Furthermore, 12.1% (n=7) of patients had severe GERD (**Table-1)** indicating that they experienced chronic and debilitating symptoms that significantly impaired their quality of life.

Table 2: Distribution of studied patients based on Age

Age Group (Years)	Frequency (n=58)	Percentage
15-25	12	20.7%
26-35	10	17.2%
36-45	17	29.3%
46-55	15	25.9%
> 55	4	6.9%
Mean ± SD	38.24 ± 13.24 (15-63 years)	

The age distribution of the study population revealed a wide range of ages, from 16 to 63 years, with mean age of 38.24 years & SD of 13.24 years. Majority of patients (29.3%, n=17) fell within the 36–45 years age group, followed closely by those in the 46-55year age group (25.9%, n=15).

The 26-35 years age group accounted for 17.2% (n=10) of the population, while the 15-25 years age group made up 20.7% (n=12) of the population and the oldest age group, above 55 years, accounted for 6.9% (n=4) of the population (**Table-2)**

Table 3: Distribution of studied patients based on Sex

Sex	Frequency (n=58)	Percentage
Male	36	62.1%
Female	22	37.9%

The sex distribution of the study population revealed a predominantly male cohort, with 62.1% (n=36) of the patients being male. In contrast, females accounted for 37.9% (n=22) of the study population (**Table-3).**

Table 4: Distribution of studied patients based on Living area

Living area	Frequency (n=58)	Percentage
Rural	24	41.4%
Urban	34	58.6%

The living area distribution of the study population revealed a slightly higher proportion of urban residents, with 58.6% (n=34) of the patients residing in urban areas. In contrast, 41.4% (n=24) of the patients lived in rural areas **(Table-4).**

Table 5: Distribution of studied patients based on Occupation

Occupation	Frequency (n=58)	Percentage
Farmer & Manual Labor	17	29.3%
Homemaker	17	29.3%
Business	11	19.0%
Teacher	10	17.2%
Service	3	5.2%

The largest proportion of patients, 29.3% (n=17), were engaged in farming or manual labor, suggesting that physically demanding occupations can be associated with increased risk of GERD. Homemakers also accounted for 29.3% (n=17) of the sample, indicating that individuals who spend more time at home may be equally likely to experience GERD symptoms.

Business professionals and teachers accounted for 19.0% (n=11) and 17.2% (n=10) of the sample, respectively, while service industry workers made up the smallest proportion 5.2% (n=3) **(Table-5)**

Table 6: Distribution of studied patients based on BMI

BMI	Frequency (n=58)	Percentage
<18	3	5.2%
18-24.9	38	65.5%
25-29.9	16	27.6%
≥30	1	1.7%
Mean ± SD	19.65 ± 2.65 (14.2-25.4 kg/m^2)	

BMI distribution of the study population revealed a predominantly normal weight cohort, with 65.5% (n=38) of patients having a BMI between 18 and 24.9 kg/m2. This was followed by 27.6% (n=16) of patients who were overweight, with a BMI between 25 and 29.9 kg/m2. A small proportion of patients, 5.2% (n=3), were underweight, with a BMI less than 18

kg/m2, while only 1.7% (n=1) of patients were obese, with a BMI ≥30 kg/m2. Mean BMI of study population was 19.65 kg/m2, with SD of 2.65 kg/m2, indicating a relatively narrow range of BMI values. **(Table-6)**

Table 7: Distribution of studied patients based on Lifestyle & dietary factors

Lifestyle and dietary factors		Frequency (n=58)	Percentage
Smoking	**Current smoker**	19	32.8%
	Ex-smoker	17	29.3%
	Non-smoker	22	37.9%
Tea	**No Intake**	21	36.2%
	< 5 cups/day	22	37.9%
	> 5 cups/day	15	25.9%
Spicy food	**Yes**	35	60.3%
	No	23	39.7%
Non-veg	**Yes**	34	58.6%
	No	24	41.4%
Diner to bed time	**≤ 2 hours**	40	69.0%
	> 2 hours	18	31.0%
Physical activity	**Sedentary**	27	46.6%
	Non-sedentary	31	53.4%

Smoking was a common habit, with 32.8% (n=19) of patients being current smokers and 29.3% (n=17) being ex-smokers, leaving 37.9% (n=22) as non-smokers.

Tea consumption was also prevalent, with 37.9% (n=22) of patients consuming less than 5 cups per day and 25.9% (n=15) consuming more than 5 cups per day, while 36.2% (n=21) did not consume tea at all. A significant proportion of patients, 60.3% (n=35), consumed spicy food, and 58.6% (n=34) consumed non-vegetarian food.

Majority of patients, 69.0% (n=40), went to bed within 2 hours of dinner, which may exacerbate GERD symptoms. In terms of physical activity, 46.6% (n=27) of patients were sedentary, while 53.4% (n=31) were non-sedentary **(Table-7).**

Table 8: Distribution of studied patients based on present Comorbidity

Comorbidity	Frequency (n=58)	Percentage
DM	6	10.3%
HTN	15	25.9%
DM + HTN	5	8.6%
Hypothy/CAD	1	1.7%
No comorbidity	31	53.4%

Hypertension (HTN) was the most common comorbidity, affecting 25.9% (n=15) of patients, followed by diabetes mellitus (DM), which was present in **10**.3% (n=6) of patients. A notable proportion of patients, 8.6% (n=5), had both DM and HTN, indicating a higher risk of cardiovascular complications. Additionally, 1.7% (n=1) of patients had hypothyroidism or coronary artery disease (CAD). However, a significant majority of patients, 53.4% (n=31), did not have any of these comorbid conditions, suggesting that GERD can occur independently of other health conditions **(Table-8).**

Table 9: Vital parameters amongst different study population

Vital parameters	Mean ± SD	Minimum	Maximum
SBP	119.97 ± 14.02	100	156
DBP	77.48 ± 7.97	64	98
HR	84.10 ± 10.87	66	118
RR	22.57 ± 2.24	18	28
SpO2	98.41 ± 0.60	94	100

The mean SBP was 119.97 mmHg, with a standard deviation (SD) of 14.02 mmHg, & range of 100-156 mmHg. The mean DBP was 77.48 mmHg, with an SD of 7.97 mmHg, & range of 64-98 mmHg. The mean heart rate (HR) was 84.10 beats per minute, with an SD of 10.87 beats per minute, & range of 66-118 beats per minute.

The mean respiratory rate (RR) was 22.57 breaths per minute, with an SD of 2.24 breaths per minute, & range of 18-28 breaths per minute. Finally, the mean oxygen saturation (SpO2) was 98.41%, with an SD of 0.60%, & range of 94-100%**(Table-9).**

Table 10: Laboratory parameters amongst different study population

Laboratory parameters	Mean ± SD	Minimum	Maximum
Haemoglobin	12.66±1.51	7.5	16.0
TLC	8697.59±2146.13	4260	17000
Neutrophils	58.62±6.63	40	76
Lymphocytes	36.72±6.38	20	50
Eosinophils	2.28±0.70	1	4
Monocytes	0.90±1.25	0	8
Absolute eosinophil count	193.52±79.25	84	384
ESR	26.81±15.89	5	70

Mean hemoglobin level was 12.66 g/dL, with standard deviation of 1.51 g/dL, & range of 7.5-16.0 g/dL, indicating that most patients had normal hemoglobin levels. The total leukocyte count (TLC) had a mean of 8697.59 cells/µL, with an SD of 2146.13 cells/µL, and a range of 4260-17000 cells/µL, which is within the normal range. The differential leukocyte count showed a mean neutrophil percentage of 58.62%, with an SD of 6.63%, & range of 40-76%, while the mean lymphocyte percentage was 36.72%, with an SD of 6.38%, & range of 20-50%.

The eosinophil percentage had a mean of 2.28%, with an SD of 0.70%, & range of 1-4%, and the absolute eosinophil count had a mean of 193.52 cells/µL, with an SD of 79.25 cells/µL, & range of 84-384 cells/µL. The erythrocyte sedimentation rate (ESR) had a mean of 26.81 mm/h, with an SD of 15.89 mm/h, & range of 5-70 mm/h, indicating a mild inflammatory response **(Table-10).**

Table 11: Lipid Profile amongst different study population

Lipid Profile	Mean ± SD	Minimum	Maximum
Total Cholestral	175.33±37.93	67	260
Triglycerides	114.33±40.96	51	217
HDL	45.53±8.01	34	67
LDL	104.91±27.15	55	165

The mean total cholesterol level was 175.33 mg/dL, with SD of 37.93 mg/dL, & range of 67-260 mg/dL, indicating that some patients had elevated cholesterol levels. The mean triglyceride level was 114.33 mg/dL, with an SD of 40.96 mg/dL, & range of 51-217 mg/dL, suggesting that some patients had borderline high or high triglyceride levels.

In contrast, the mean HDL cholesterol level was 45.53 mg/dL, with an SD of 8.01 mg/dL, & range of 34-67 mg/dL, indicating that most patients had normal to high HDL levels. The mean LDL cholesterol level was 104.91 mg/dL, with an SD of 27.15 mg/dL, & range of 55-165 mg/dL, suggesting that some patients had elevated LDL levels **(Table-11).**

Table 12: Kidney function test Profile amongst different study population

Kidney Function Test	Mean ± SD	Minimum	Maximum
Serum Urea	27.59±10.43	10	58
Serum Creatinine	0.71±0.28	0.2	1.5
Serum Sodium	134.02±4.40	121	142
Serum Potasium	4.06±0.49	2.7	5.0

The mean serum urea level was 27.59 mg/dL, with SD of 10.43 mg/dL, & range of 10-58 mg/dL, indicating that some patients had slightly elevated urea levels, while others had normal levels. The mean serum creatinine level was 0.71 mg/dL, with an SD of 0.28 mg/dL, & range of 0.2-1.5 mg/dL, suggesting that most patients had normal renal function. The mean serum sodium level was 134.02 mmol/L, with an SD of 4.40 mmol/L, & range of 121-142 mmol/L, indicating that most patients had normal sodium levels. Similarly, the mean serum potassium level was 4.06 mmol/L, with an SD of 0.49 mmol/L, & range of 2.7-5.0 mmol/L, suggesting that most patients had normal potassium levels **(Table-12).**

Table 13: Mean Spirometry parameters amongst study population

Mean Spirometry parameters	Mean ± SD	Minimum	Maximum
FEV1%	27.39±9.26	13	48
FVC%	46.71±12.81	29	74
FEV1/ FVC%	58.42±9.45	38	77

The mean forced expiratory volume in 1 second (FEV1) percentage was 27.39% ± 9.26%, with range of 13-48%, indicating severe airflow limitation. The mean forced vital capacity (FVC) percentage was 46.71% ± 12.81%, with range of 29-74%, suggesting significant reduction in lung volume.

The mean FEV1/FVC ratio was 58.42% ± 9.45%, with range of 38-77%, which consistent with an obstructive pattern of lung disease **(Table-13)**

Table 14: Severity of asthma amongst study population

Severity of asthma	Frequency (n=58)	Percentage
No Asthma	20	34.5%
Mild	16	27.6%
Moderate	13	22.4%
Severe	9	15.5%

A significant proportion of patients, 34.5% (n=20), did not have asthma, indicating that they may have been experiencing symptoms of GERD without any underlying asthma.

Amongst those with asthma, 27.6% (n=16) had mild asthma, 22.4% (n=13) had moderate asthma, and 15.5% (n=9) had severe asthma. This distribution suggests that asthma severity ranged from mild to severe in this population, with a slightly higher proportion of patients having mild asthma**(Table-14).**

Table 15: Association of severity of asthma with severity of GERD

GERD	Asthma				Total
	Nil	Mild	Moderate	Severe	
Mild	20	16	0	0	36
Moderate	0	0	13	2	15
Severe	0	0	0	7	7
Total	20	16	13	9	58

The association between severity of asthma and the severity of GERD revealed a notable correlation. Patients with mild GERD symptoms were likely to have mild asthma, with 20 patients having both mild GERD and mild asthma. In contrast, patients with moderate GERD symptoms were likely to have moderate asthma, with 13 patients having both moderate GERD and moderate asthma.

Furthermore, patients with severe GERD symptoms were likely to have severe asthma, with 7 patients having both severe GERD and severe asthma. Notably, there were no patients with mild GERD who had moderate or severe asthma, and no patients with severe GERD who had mild asthma**(Table-15).**

DISCUSSION

This study demonstrated a 65.5% prevalence of asthma among GERD patients, higher than global estimates (30–50%). Similar to Kaur et al. 2018, Western U.P[2]. we found that GERD severity correlated with asthma severity.

Lifestyle risk factors, including spicy diet, non-vegetarian meals, late-night eating, smoking, and sedentary behavior, were strongly associated, consistent with Parasher et al. 2021[3] The bidirectional pathophysiology is supported by:Reflux theory: micro-aspiration causing bronchospasm.

1) Reflex theory: vagal-mediated reflex bronchoconstriction.
2) Asthma-induced GERD: negative intrathoracic pressure, β-agonists, theophylline lowering LES tone.

Our findings support meta-analyses (Havemann 2007[4]; Mallah 2021[5] showing GERD contributes to asthma exacerbations. Importantly, patients with severe asthma had higher GERD prevalence, underlining the need for screening.

CONCLUSION

Asthma is highly prevalent among GERD patients in Western Uttar Pradesh, and its severity is strongly associated with GERD severity. Clinicians should actively screen for asthma in GERD patients and vice versa. Lifestyle modification and early integrated management are critical for improved outcomes.

Limitations of this study:

1) The study only included patients who visited the hospital, which may have introduced selection bias, thus, the sample size of the study was limited, which may not be representative of the entire population.

2) The study's cross-sectional design did not allow for the establishment of causality between GERD & asthma.
3) The study didn't include a control group, which made it difficult to compare the results with a healthy population.

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