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Assessment of Gastrointestinal, Sleep Problems, and Their Impact on Quality of Life of Rural Populations in Tertiary Care Hospitals in Lahore

Maria Ishtiaq[1], Dr. Saima Abbas[2]*, Dr. Faizan Fazil[3], Dr. Waqar Khalid[4], Muhammad Osama Ans[5], Dr. Muhammad Bilal[6], Dr. Um-e-Aiman[7], Dr. Muhammad Sarfraz[8], Dr. Muhammad Faisal[9]

[1]Clinical Psychologist, Pak Red Crescent Medical & Dental College, Dina Nath, Lahore, Pakistan.
[2]PhD in Clinical Psychology, Graduate Research School, University of Cyberjaya
[3]House Officer, Pak Red Crescent Teaching Hospital, Lahore, Pakistan.
[4]House Officer, Pak Red Crescent Medical & Dental College, Dina Nath, Lahore, Pakistan.
[5]Final Year MBBS Student, Pak Red Crescent Medical and Dental College, Lahore, Pakistan.
[6]House Officer, Shalamar Medical and Dental College, Mayo Hospital Lahore, Pakistan.
[7]House Officer, Pak Red Crescent Medical & Dental College, Dina Nath, Lahore, Pakistan.
[8]House Officer, Amna Inayat Medical College, Sheikhupura, Pakistan.
[9]House Officer, Pak Red Crescent Medical & Dental College, Dina Nath, Lahore, Pakistan.

***Corresponding Author:**
Email ID : Saimatherapist5@gmail.com

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ABSTRACT

Gastrointestinal (GI) and sleep disorders are two of the most prevalent health problems in the world. In rural settings, the impact of these disorders is compounded by economic factors, access to healthcare, and culturally held beliefs about health. The two-way interplay between GI disorders and insomnia and their joint contribution to quality of life (QoL) is especially under-explored in rural settings. This study examines the burden of GI disorders and related sleep problems on QoL among residents in rural areas who are planning to visit tertiary care hospitals in Lahore. It also outlines the demographic and socio-economic factors most likely to have the greatest influence on the deteriorating impact of these disorders on QoL. A cross-sectional quantitative study design was employed to collect data from 200 participants aged above 18 years residing in the rural area surrounding tertiary care hospitals in Lahore; fifty potential participants were excluded out of those selected due to incomplete questionnaires or not fulfilling the inclusion criteria. Thus, the final analysis was conducted on 150 samples. Participants were selected through systematic random sampling, and the WHOQOL-BREF, PSQI, and GSRS were administered. The information was analyzed using IBM SPSS 27 software, applying Spearman's rank correlation and the Mann-Whitney U test. The study concluded that GI disorders significantly correlate with sleep quality ($r_s = 0.165$, $p < 0.05$). There was also a significant inverse association between QoL and sleep quality ($r_s = -0.572$, $p < 0.001$). Age, marital status, educational status, and employment significantly impacted QoL. Residents from rural areas reported lower QoL than those residing in urban areas ($p = 0.048$). The correlation between gastrointestinal symptoms and sleep disturbances provides empirical support for gut-brain axis mechanisms previously described in the literature. The research highlights that GI and sleep disorders profoundly affect QoL, especially in rural populations. The data indicate that addressing GI and sleep disorders simultaneously could improve health outcomes. The research demonstrates how healthcare deficits combine with the rural population's specific socio-economic and cultural factors, advocating for comprehensive approaches to improve integrated care and better QoL.

Keywords: *Sleep Disorders, Quality of Life, Gastrointestinal Disorders, Tertiary Care, Rural Populations, Socio-Economic Factors.*

1. INTRODUCTION

Gastrointestinal disorders and sleep disorders form a complicated web of health issues affecting millions of people worldwide. The World Gastroenterology Organization reports that functional gastrointestinal disorders, such as irritable

bowel syndrome (IBS) and functional dyspepsia, have prevalence rates of 10-25% respectively, with lower and middle-income countries registering higher figures (1). Similarly, insomnia and obstructive sleep apnea (OSA), along with restless leg syndrome, impact approximately 30% of the adult population worldwide, particularly chronic disease patients and those under severe stress (2,3).

The gut-brain axis represents a bidirectional communication network linking the central nervous system with the enteric nervous system through neural, hormonal, and immunological pathways (4). Recent systematic reviews and meta-analyses demonstrate that this axis involves multiple mechanisms including vagal nerve signaling, hypothalamic-pituitary-adrenal axis activation, inflammatory mediator release, and microbiota-derived metabolites (5,6). Sleep deprivation disrupts circadian regulation of gut motility, increases intestinal permeability through tight junction protein alterations, and significantly alters gut microbiome composition, leading to increased production of inflammatory cytokines such as TNF-α and IL-6 (7,8). On the other hand, gastrointestinal inflammation and visceral hypersensitivity may trigger ascending nociceptive pathways that interfere with sleep architecture, decrease REM sleep, and lower overall sleep efficiency (9,10).

These disorders are still highly interrelated by well-established neurobiological processes that have been confirmed to multiple populations. Data from recent longitudinal studies indicate that lack of sleep aggravates the severity of GI symptoms through the dysregulation of the stress response system, whereas chronic GI disorders disrupt the sleep pattern through pain-mediated and inflammatory mechanisms (11). The overlap of chronic gastrointestinal diseases, sleep disorders, and socio-economic disparities imposes a disproportionately heavy burden on the rural population. In the developing world like Pakistan, individuals are deprived of the benefit of tertiary-level healthcare facilities and trained gastroenterologists or sleep specialists (12), leading to long diagnostic delays and inadequate treatment strategies. Cultural misunderstandings and indigenous health beliefs also restrict active management of these diseases. For example, in rural Pakistan, GERD and chronic constipation are frequently misdiagnosed as being caused by bad eating habits or spiritual imbalances instead of being identified as medical conditions needing systematic treatment (13). Additionally, sleeping disorders are frequently attributed to tension or physical exhaustion from farming work instead of being identified as independent medical conditions that need specialized intervention (14). Recent studies from South Asian populations have emphasized the bidirectional relationship between gastrointestinal disorders and sleep disorders, which are mainly mediated via the described gut-brain axis (15). This neurobiological mechanism connects the central nervous and gastrointestinal systems at neural, endocrine, and immune levels through sophisticated feedback regulation. Pathological alterations within this axis, such as increased visceral pain sensitivity, dysfunctional stress response systems, and altered neurotransmitter signaling, are recognized as significant contributors to both gastrointestinal and sleep disorders in vulnerable populations (16).

Using G*Power version 3.1.9.7, we conducted a comprehensive post-hoc power analysis for our primary correlational findings. For the correlation between quality of life and sleep quality ($r_s = -0.572$) with $n=150$ and $\alpha=0.05$, the achieved power was 1.00, indicating more than adequate statistical power. For the correlation between sleep quality and gastrointestinal symptoms ($r_s = 0.165$) with $n=150$ and $\alpha=0.05$, the achieved power was 0.89, exceeding the conventional threshold. For the correlation between quality of life and gastrointestinal symptoms ($r_s = -0.229$) with $n=150$ and $\alpha=0.05$, the achieved power was 0.99. All analyses exceeded the conventional power threshold of 0.80, confirming adequate statistical power for detecting the observed effect sizes and supporting the validity of our findings.

Pakistan, similar to many developing nations, is experiencing a significant epidemiological transition with increasing prevalence of non-communicable diseases, particularly GI and sleep disorders, among rural populations. However, patients from rural areas frequently encounter barriers when seeking care at tertiary hospitals in major cities like Lahore (17). Research indicates that a substantial portion of Pakistan's rural population is affected by gastrointestinal disorders such as irritable bowel syndrome, gastroesophageal reflux disease, and functional dyspepsia. These diseases are usually caused by numerous factors, such as unhealthy nutrition, polluted water source, infectious disease burden, and restricted access to preventive health care services (18).

Members of rural communities also experience a number of sleep disorders, including obstructive sleep apnea and chronic insomnia (19). Such conditions, coupled with low health literacy and levels of education, are also compounded by the unavailability of diagnostic centers and specialists to offer treatment in healthcare facilities within the rural areas (19). Notwithstanding this hefty disease burden, a very large knowledge gap continues to exist in examining the comorbidity between sleep disorders and GI disorders and their combined quality-of-life effect within rural populations. Much recent research addresses urban populations or single disease subgroups, creating a critical knowledge deficit for these essential health concerns within underserved rural communities.

2. RESEARCH RATIONALE

This study fills the said gaps by scrutinizing the prevalence, severity, and associations of sleep disorders and gastrointestinal disorders among the rural patients receiving treatment in Lahore's tertiary care hospitals. The study shall quantify the effects of self-reported GI and sleep disorders on several dimensions of quality of life while identifying demographic and socio-economic variables that could mitigate or aggravate such effects. This research is intended to enhance the epidemiological evidence base that informs public health policy development, healthcare system strengthening initiatives, and evidence-based

interventions addressing these conditions in resource-limited settings.

3. OBJECTIVES

Primary Objective. To evaluate the impact of gastrointestinal disorders and their association with sleep disorders on quality of life among rural communities residing in areas served by tertiary care facilities in Lahore.

Secondary Objectives. The secondary aims include evaluating the strength and direction of associations between GI symptoms and sleep quality parameters, identifying specific demographic and socioeconomic characteristics that modify these relationships, and assessing the differential impact of coexisting GI and sleep disorders on the physical health, psychological wellbeing, social relationship, and environmental domains of quality of life.

Hypotheses

The research was designed to test several specific hypotheses. First, we hypothesized that GI disorders would demonstrate a significant inverse association with quality of life, with increasing symptom severity corresponding to more profound QoL impairment across multiple domains. Second, we predicted that sleep disturbances would independently predict reduced QoL and functional performance, potentially mediating some effects of gastrointestinal symptoms. Third, we hypothesized that the coexistence of GI and sleep disorders would contribute to a more significant decline in QoL than either disorder alone, suggesting additive or synergistic effects. Finally, we predicted that socioeconomic and demographic characteristics such as educational attainment, household income level, and gender would significantly moderate the relationship between these disorders and quality of life outcomes.

4. LITERATURE REVIEW

Functional gastrointestinal disorders, now more appropriately termed disorders of gut-brain interaction, affect a substantial portion of the global population across diverse geographic and cultural contexts. A comprehensive multinational study involving 73,076 participants from 33 countries found that over 40% had been diagnosed with at least one functional gastrointestinal disorder, revealing the remarkable extent and universal nature of these conditions (20). The global burden of disease attributable to digestive system disorders remains considerable, with recent systematic analyses showing mixed trends in different regions and conditions.

Contemporary studies have extensively examined the bidirectional interactions between sleep disorders, particularly obstructive sleep apnea, and various gastrointestinal diseases. A recent Mendelian randomization study provided compelling evidence for a causal relationship between genetically predicted OSA and inflammation-related gastrointestinal diseases, demonstrating that this association exists independently of traditional confounding variables and further illuminating the complex interplay between sleep and gastrointestinal health (21).

Well-documented disparities exist between rural and urban populations regarding health outcomes, clinical care access, health behaviors, and social determinants of health. Comprehensive analyses of recent epidemiological data have revealed substantial inequities, with significantly poorer health outcomes and reduced healthcare access documented in rural counties across multiple countries. These persistent gaps highlight the urgent need for tailored intervention strategies that address the particular challenges faced by rural populations (22).

Chronic sleep deprivation and related sleep disorders have been causally linked with a wide spectrum of chronic diseases through multiple pathophysiological mechanisms. Addressing sleep problems has been shown to improve both individual health outcomes and community-level health indicators. Evidence-based sleep health promotion programs can significantly reduce existing health disparities, particularly among ethnic and racial minority populations who experience disproportionate rates of sleep disorders (23).

Anxiety and depressive disorders demonstrate well-established bidirectional relationships with irritable bowel syndrome and other functional gastrointestinal disorders. Research consistently indicates that individuals suffering from IBS have substantially increased likelihood of developing clinically significant anxiety and depression, demonstrating the critical need for integrated treatment approaches that simultaneously address both gastrointestinal symptoms and psychological health (24).

Dietary interventions play essential roles in the management of functional gastrointestinal disorders, with treatment approaches varying significantly across different cultural and regional contexts. Non-pharmacological treatment options, encompassing psychological, behavioral, and dietary interventions, show considerable variation based on local food systems, cultural practices, and healthcare infrastructure. Developing effective global strategies requires a thorough understanding of regional dietary patterns and their interactions with gastrointestinal health (25).

Lifestyle changes such as diet modification, programmed exercise regimens, and coordinated stress management have been found to exert profound effects on gut microbiome complexity and the severity of gastrointestinal symptoms. An increasing body of evidence justifies the addition of mind-body therapies, certain herbal extracts, targeted nutritional supplements, and other complementary techniques as useful additions to standard medical therapies of prevalent diseases like IBS and

gastroesophageal reflux disease (26).

Unhealthy eating habits and poor-quality sleep are significant modifiable risk factors for depression and other psychiatric disorders. Recent studies have examined the intricate relationships between dietary quality markers, sleep duration patterns, and depression symptoms, highlighting the role of holistic lifestyle interventions as central aspects of integrated mental health treatment programs (27).

5. RESEARCH METHODOLOGY

Study Design

This research utilizes a cross-sectional descriptive design to consecutively evaluate the effects of sleep disorders and gastrointestinal illnesses on quality of life among rural patients receiving treatment in tertiary hospitals of Lahore. The cross-sectional methodology facilitates the investigation of associations between more than one variable at a given point in time, offering important information on the relationships of GI diseases, sleep quality, and QoL while recognizing the limitations of inferring causality from such studies.

Study Population and Sampling

The target population encompassed individuals 18 years and older residing in rural areas who sought healthcare services at major tertiary care hospitals in Lahore for gastrointestinal complaints, sleep-related concerns, or related symptoms. Rural residence was operationally defined as living more than 50 kilometers from major urban centers, consistent with Pakistan Bureau of Statistics definitions.

Inclusion and Exclusion Criteria

Inclusion criteria specified age 18 years or older, confirmed rural residence as defined above, presentation with gastrointestinal or sleep-related complaints, ability to provide informed consent, and functional literacy in Urdu or English sufficient to complete questionnaires. Exclusion criteria included severe cognitive impairment that would preclude reliable questionnaire completion, active psychiatric disorders requiring hospitalization, current pregnancy to avoid confusion between gestational and gastrointestinal symptoms, and incomplete questionnaire responses defined as more than 20% missing data.

Sample Size Calculation

Initial power analysis indicated that 200 participants would be required for detecting medium effect sizes ($r=0.30$) with 80% power and $\alpha=0.05$. However, due to logistical constraints during data collection and participant exclusions, the final sample comprised 150 participants. The participant flow included initial recruitment of 200 potential participants, exclusion of 50 individuals due to incomplete questionnaires ($n=35$, representing 17.5%) or failure to meet inclusion criteria ($n=15$, representing 7.5%), resulting in a final sample of 150 participants and an overall response rate of 75%.

Systematic random sampling was employed rather than simple random sampling to ensure more uniform representation across demographic and socioeconomic strata. Every third eligible participant was selected from the sampling frame, which was constructed based on hospital registration records of patients presenting with relevant complaints during the study period.

Instruments

The research utilized four validated instruments for comprehensive data collection. A demographic data form developed specifically for this study documented participants' age, gender, marital status, educational attainment, occupational status, household income, and existing medical conditions. The WHO Quality of Life Scale Brief Version (WHOQOL-BREF) assessed participants' perceptions of their quality of life across four domains, including physical health, psychological well-being, social relationships, and environmental factors. This instrument uses a 5-point Likert scale with responses ranging from "very poor" to "very good" and has demonstrated excellent psychometric properties across diverse cultural contexts.

The Pittsburgh Sleep Quality Index (PSQI) evaluated sleep quality during the preceding month across seven component domains, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Global PSQI scores range from 0 to 21, with higher scores indicating poorer sleep quality. The instrument has been extensively validated and shows strong reliability across different populations.

The Gastrointestinal Symptom Rating Scale (GSRS) measured the frequency and severity of gastrointestinal symptoms including abdominal pain, bloating, nausea, diarrhea, constipation, and reflux symptoms. Participants rated symptoms using a 7-point scale ranging from "no discomfort" to "very severe discomfort." The GSRS demonstrates excellent internal consistency and has been validated for use in both clinical and research settings.

Data Collection Procedure

Data collection followed a rigorously structured protocol designed to ensure consistency and minimize bias. Prior to study initiation, ethical approval was obtained from the institutional ethics committee of Pak Red Crescent Medical and Dental

College. Participants were recruited during scheduled visits to participating tertiary care hospitals, and written informed consent was obtained after comprehensive explanation of study objectives, procedures, and confidentiality measures.

Trained research assistants administered questionnaires to participants in private settings to ensure confidentiality and encourage honest responses. Research assistants received standardized training on questionnaire administration, data collection procedures, and strategies for minimizing response bias. Regular supervision and quality checks were conducted throughout the data collection period to ensure adherence to protocols and maintain data quality standards.

Data Analysis

Data entry and analysis were conducted using IBM SPSS version 27. Numerical variables are presented as median values with interquartile ranges due to non-normal distributions, while categorical variables are presented as frequencies and percentages. Quality of life was assessed using total WHOQOL-BREF scores, sleep quality was evaluated using global PSQI scores, and gastrointestinal symptom severity was quantified using total GSRS scores.

Normality of distributions was formally assessed using the Shapiro-Wilk test, which revealed non-normal distributions for quality of life scores ($p=0.036$), PSQI scores ($p<0.001$), and GSRS scores ($p<0.001$). Given the non-parametric nature of the data, correlations between continuous variables were assessed using Spearman's rank correlation coefficient rather than Pearson correlation. Associations between quality of life categories and demographic variables were evaluated using chi-square tests of independence. Between-group differences in continuous variables were assessed using the Mann-Whitney U test for two-group comparisons. Statistical significance was established at $p\leq0.05$ for all analyses.

Ethical Considerations

Ethical considerations were prioritized throughout all phases of the study. Participant confidentiality was strictly maintained through secure data storage procedures and de-identification of all records used for analysis purposes. All data collected were used exclusively for research purposes as specified in the informed consent process. Participants retained the right to withdraw from the study at any time without consequences or impact on their medical care. These procedures ensured that the study adhered to international ethical standards while effectively addressing the research objectives.

6. RESULTS

Demographic Characteristics of Study Population

Among the 150 participants included in the final analysis, age distribution showed 25 individuals (16.7%) aged 18-25 years, 33 individuals (22.0%) aged 26-35 years, 37 individuals (24.7%) aged 36-45 years, and 55 individuals (36.7%) aged 46-60 years. Gender distribution was nearly equal with 74 males (49.3%) and 76 females (50.7%). The majority of participants, 126 individuals (84.0%), were married while 24 (16.0%) were single. Geographic distribution confirmed the rural focus with 124 participants (82.7%) from rural areas and 26 (17.3%) from urban areas who met inclusion criteria.

Educational attainment revealed significant challenges with 69 participants (46.0%) having no formal education, 40 individuals (26.7%) having completed elementary education, 24 participants (16.0%) having attended high school, 16 individuals (10.7%) being university graduates, and only 1 participant (0.7%) holding a professional degree. Employment status showed that 112 participants (74.7%) were unemployed, while 38 (25.3%) were employed in various occupations. Disease awareness was high, with 146 participants (97.3%) reporting awareness of their condition compared to 4 individuals (2.7%) who were unaware.

Quality of Life Outcomes

Quality of life assessment revealed that 1 participant (0.7%) reported poor quality of life, 69 individuals (46.0%) reported moderate quality of life, 70 participants (46.7%) reported good quality of life, and 10 individuals (6.7%) reported very good quality of life. Statistical analysis demonstrated significant associations between quality of life and several demographic variables, including age ($p<0.001$), marital status ($p=0.020$), geographic residency ($p=0.023$), educational status ($p<0.001$), and employment status ($p<0.001$), as detailed in Table 1.

Table 1: Association of Quality of Life with Demographics and Sleep Quality Parameters

Demographics	Categories	Quality of Life Distribution				p-value
		Poor n (%)	Moderate n (%)	Good n (%)	Very Good n (%)	
Gender	Male (n=74)	0 (0.0)	28 (37.8)	40 (54.1)	6 (8.1)	0.129
	Female (n=76)	1 (1.3)	41 (53.9)	30 (39.5)	4 (5.3)	

Age Groups	18-25 years (n=25)	1 (4.0)	5 (20.0)	18 (72.0)	1 (4.0)	<0.001*
	26-35 years (n=33)	0 (0.0)	11 (33.3)	17 (51.5)	5 (15.2)	
	36-45 years (n=37)	0 (0.0)	15 (40.5)	21 (56.8)	1 (2.7)	
	46-60 years (n=55)	0 (0.0)	38 (69.1)	14 (25.5)	3 (5.5)	
Marital Status	Single (n=24)	0 (0.0)	5 (20.8)	15 (62.5)	4 (16.7)	0.020*
	Married (n=126)	1 (0.8)	64 (50.8)	55 (43.7)	6 (4.8)	
Residency	Rural (n=124)	0 (0.0)	62 (50.0)	56 (45.2)	6 (4.8)	0.023*
	Urban (n=26)	1 (3.8)	7 (26.9)	14 (53.8)	4 (15.4)	
Education	Illiterate (n=69)	0 (0.0)	46 (66.7)	20 (29.0)	3 (4.3)	<0.001*
	Elementary (n=40)	1 (2.5)	15 (37.5)	23 (57.5)	1 (2.5)	
	High school (n=24)	0 (0.0)	4 (16.7)	18 (75.0)	2 (8.3)	
	Graduate (n=16)	0 (0.0)	4 (25.0)	9 (56.3)	3 (18.8)	
	Professional (n=1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	
Employment	Employed (n=38)	0 (0.0)	7 (18.4)	27 (71.1)	4 (10.5)	<0.001*
	Unemployed (n=112)	1 (0.9)	62 (55.4)	43 (38.4)	6 (5.4)	

Note. *p < 0.05

Rural-Urban Comparisons

Comparative analysis between rural and urban participants revealed significant differences in several key outcomes, as presented in Table 2.

Table 2: Rural-Urban Comparison of Health Outcomes (Mann-Whitney U Test)

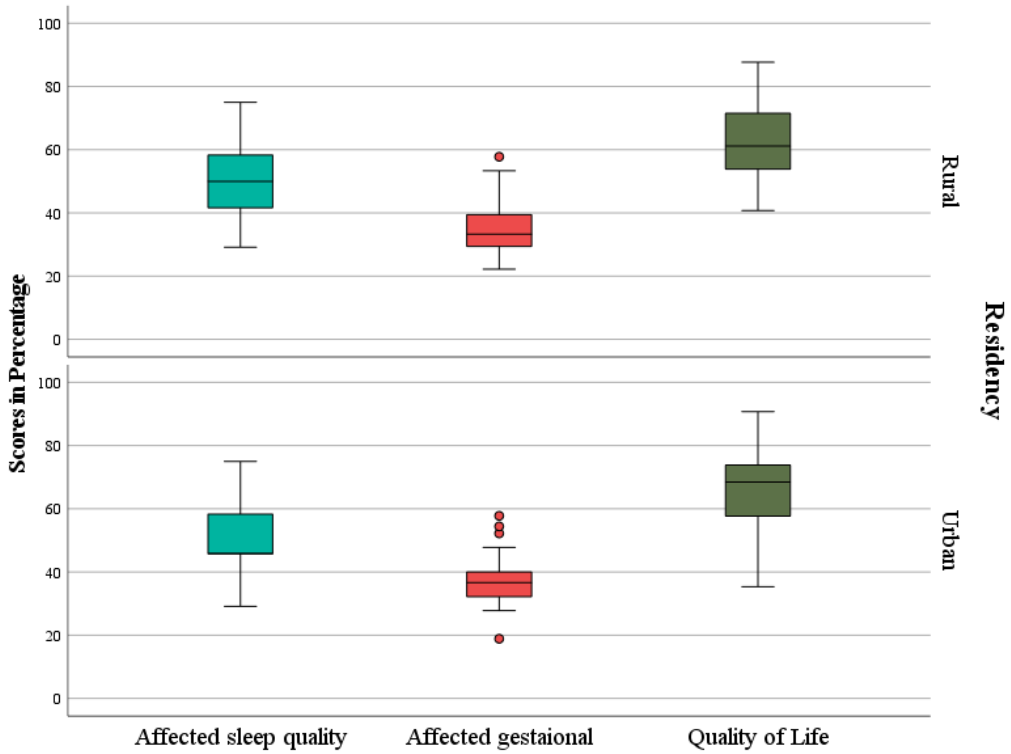
Variable	Rural Participants (n=124)	Urban Participants (n=26)	p-value
	Mean ± SD	Mean ± SD	
Quality of Life Total Score	62.23 ± 11.05	66.63 ± 12.39	0.048*
WHOQOL-BREF Domains			
Overall Quality of Life	58.23 ± 18.08	66.92 ± 21.87	0.030*
Physical Health	57.83 ± 15.15	65.39 ± 14.42	0.038*
Psychological Health	66.77 ± 13.09	69.36 ± 14.82	0.369
Social Relationships	72.80 ± 12.77	71.28 ± 15.41	0.860
Environmental Domain	59.70 ± 11.02	63.85 ± 12.29	0.119
Sleep and Stress Measures			
Stress Index Score	6.02 ± 2.70	6.08 ± 2.86	0.857
PSQI Sleep Disturbance	1.43 ± 0.50	1.38 ± 0.50	0.689
PSQI Daytime Dysfunction	1.02 ± 0.56	1.15 ± 0.67	0.298
PSQI Sleep Medication Use	0.31 ± 0.71	0.42 ± 0.86	0.506
PSQI Subjective Sleep Quality	1.55 ± 0.90	1.38 ± 0.94	0.490

Gastrointestinal Symptoms			
GSRS Total Score	31.43 ± 6.54	33.85 ± 7.85	0.084

Note. *p < 0.05

The mean quality of life index score was significantly lower among rural residents (62.23±11.05) compared to urban residents (66.63±12.39), with this difference reaching statistical significance (p = 0.048). Stress index scores showed a minimal difference between rural residents (6.02±2.70) and urban residents (6.08±2.86), with this difference being statistically non-significant (p = 0.857). Gastrointestinal symptom scores were slightly lower among rural residents (31.43±6.54) compared to urban residents (33.85±7.85), but this difference did not reach statistical significance (p = 0.084).

Figure 1: Box Plots Comparing Gastrointestinal Symptoms and Sleep Quality with Quality of Life between Rural and Urban Populations



Spearman's rank correlation analysis revealed several significant relationships between study variables, as summarized in Table 3.

Table 3: Spearman's Rank Correlation Matrix for Primary Study Variables

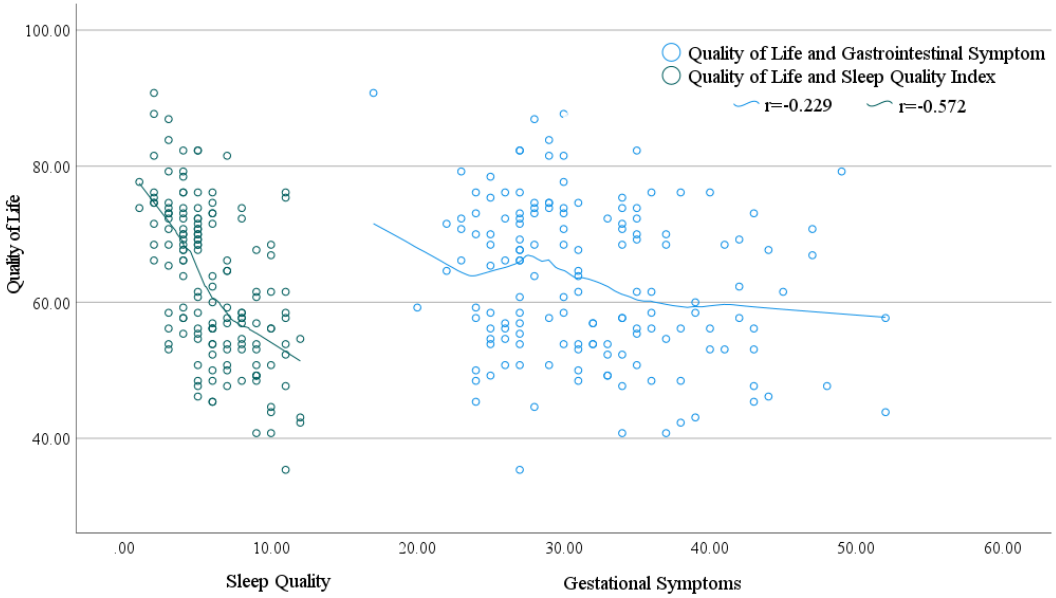
Variables	Quality of Life	PSQI	GSRS
Quality of Life	1.000	-0.572***	-0.229**
Sleep Quality (PSQI)	-0.572***	1.000	0.165*
Gastrointestinal Symptoms (GSRS)	-0.229**	0.165*	1.000

Note: Higher PSQI scores indicate poorer sleep quality; higher GSRS scores indicate more severe gastrointestinal symptoms. *p < 0.05, **p < 0.01, ***p < 0.001

There was a moderate inverse correlation between quality of life and sleep quality (rs = -0.572, p < 0.001), indicating that poorer sleep quality was associated with lower quality of life scores. A weak inverse correlation was observed between quality of life and gastrointestinal symptoms (rs = -0.229, p < 0.01), suggesting that more severe gastrointestinal symptoms were associated with reduced quality of life, though this relationship was less strong than that observed with sleep quality. Additionally, a weak positive correlation was found between sleep quality problems and gastrointestinal symptoms (rs =

0.165, $p < 0.05$), indicating that individuals experiencing more severe sleep disturbances also tended to report more severe gastrointestinal symptoms.

FIGURE 2: Scatter Plot Displaying Correlational Relationships Between Sleep Quality, Gastrointestinal Symptoms, and Quality of Life



Quality of Life Associations

The comprehensive analysis revealed that quality of life demonstrated significant associations with multiple demographic and clinical variables, while showing no significant associations with gender or disease awareness. Younger participants, particularly those aged 18-25 years, reported significantly better quality of life compared to older age groups, with the strongest differences observed in the 46-60 year age group where 69.1% reported only moderate quality of life. Single individuals reported better quality of life outcomes compared to married participants, with 62.5% of single individuals reporting good quality of life compared to 43.7% of married individuals.

Urban residents demonstrated significantly better quality of life outcomes compared to rural residents, with 53.8% of urban residents reporting good quality of life and 15.4% reporting very good quality of life, compared to 45.2% and 4.8% respectively, among rural residents. Educational status showed a clear gradient relationship with quality of life, where 66.7% of individuals with no formal education reported only moderate quality of life, while educational attainment was associated with progressively better quality of life outcomes.

Employment status significantly influenced quality of life outcomes, with employed individuals showing substantially better outcomes compared to unemployed participants. Among employed individuals, 71.1% reported good quality of life and 10.5% reported very good quality of life, compared to 38.4% and 5.4% respectively among unemployed participants.

Sleep Quality Factors and Quality of Life

Several sleep quality parameters demonstrated significant associations with quality of life outcomes. Participants with less frequent sleep disturbances (less than once per week) showed significantly better quality of life, with 63.2% reporting good quality of life and 11.5% reporting very good quality of life. In contrast, those experiencing sleep disturbances once or twice per week showed poorer outcomes, with 74.6% reporting only moderate quality of life.

Daytime dysfunction showed strong associations with quality of life, where participants with no daytime dysfunction during the past month reported better outcomes (57.9% good quality of life) compared to those experiencing daytime dysfunction three or more times per week, who showed more variable quality of life patterns. Subjective sleep quality ratings demonstrated the strongest associations with quality of life outcomes, where participants rating their sleep as "very good" reported substantially better quality of life (68.8% good, 25.0% very good) compared to those rating their sleep as "very bad" (80.8% moderate, 19.2% good quality of life).

7. DISCUSSION

The results from this comprehensive study highlight the substantial impact of gastrointestinal disorders and sleep disturbances on quality of life among rural populations seeking care at tertiary hospitals in Lahore. The findings demonstrate several critical relationships that have important implications for healthcare delivery and policy development in resource-limited settings. The strong inverse correlation between sleep quality and quality of life ($r_s = -0.572$, $p < 0.001$) represents one of the most significant findings, indicating that sleep disturbances exert profound effects on overall well-being that extend beyond simple fatigue or daytime sleepiness. This relationship appears to be stronger than the association between gastrointestinal symptoms and quality of life ($r_s = -0.229$, $p < 0.01$), suggesting that interventions targeting sleep quality may yield more substantial improvements in patient-reported outcomes than those focusing exclusively on gastrointestinal symptoms.

The significant rural-urban disparity in quality of life outcomes supports existing literature documenting health inequities between these populations (22). Rural residents demonstrated consistently lower quality of life scores compared to urban residents, which likely reflects the cumulative effects of multiple disadvantages, including reduced healthcare access, lower socioeconomic status, limited educational opportunities, and inadequate health literacy. These findings underscore the need for targeted interventions that address the specific challenges faced by rural populations.

The moderate positive correlation between gastrointestinal symptoms and sleep disturbances ($r_s = 0.165$, $p < 0.05$) provides empirical support for the gut-brain axis hypothesis and validates the bidirectional relationship between these systems that has been described in recent mechanistic studies (15,16). This relationship suggests that comprehensive treatment approaches addressing both symptom domains simultaneously may be more effective than treating each condition in isolation.

Demographic factors demonstrated significant associations with quality of life outcomes, with age, educational attainment, and employment status showing particularly strong relationships. The finding that illiterate participants and unemployed individuals reported significantly lower quality of life scores highlights the intersection between health outcomes and social determinants of health. These relationships emphasize that effective interventions must address not only clinical symptoms but also the broader socioeconomic factors that influence health and well-being in rural populations. The study's identification of sleep disturbances as potentially more impactful on quality of life than gastrointestinal symptoms has important clinical implications. Healthcare providers working with rural populations experiencing both types of symptoms might achieve greater patient benefit by prioritizing sleep-focused interventions alongside standard gastrointestinal treatments. This approach could be particularly valuable in resource-limited settings where comprehensive specialist care may not be readily available.

The high disease awareness reported by 97.3% of participants suggests that educational interventions have been effective in these communities, though the persistence of symptoms despite awareness indicates that knowledge alone is insufficient to address these health challenges. This finding highlights the need for interventions that go beyond education to address structural barriers to care, including healthcare access, affordability, and availability of appropriate treatments.

8. CONCLUSION

This research provides compelling evidence for the significant burden imposed by gastrointestinal and sleep disorders on quality of life, particularly among rural populations in Pakistan. The study demonstrates that sleep disturbances may exert more profound effects on quality of life than gastrointestinal symptoms, though both contribute meaningfully to reduced wellbeing. The identification of significant rural-urban disparities in health outcomes emphasizes the urgent need for healthcare policies and interventions specifically designed to address the unique challenges faced by rural populations. The empirical validation of relationships between gastrointestinal symptoms and sleep disturbances supports integrated treatment approaches that simultaneously address both symptom domains rather than treating them as separate clinical entities. Healthcare systems serving rural populations should consider developing comprehensive care models that incorporate sleep health assessments and interventions alongside traditional gastrointestinal treatments.

The significant associations between quality of life outcomes and sociodemographic factors, including education and employment status, indicate that effective healthcare interventions must address broader social determinants of health rather than focusing exclusively on clinical symptoms. Future healthcare initiatives should incorporate strategies for improving educational access, economic opportunities, and social support systems alongside medical treatments.

The findings suggest several priorities for future research and intervention development. Longitudinal studies examining the temporal relationships between gastrointestinal symptoms, sleep disturbances, and quality of life would provide valuable insights into causal mechanisms and optimal timing for interventions. Additionally, culturally appropriate intervention studies testing integrated treatment approaches specifically designed for rural populations could inform evidence-based practice guidelines for similar settings globally. Healthcare policy makers should consider these findings when developing strategies to address non-communicable disease burdens in rural areas, particularly given the growing recognition that functional gastrointestinal disorders and sleep disturbances represent significant sources of disability and reduced quality of life in these populations.

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