

Relationship between Insomnia and Gastrointestinal Disease And Moderating Role of Stress

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ABSTRACT

This study aims to find whether there is an association between Gastrointestinal diseases (GI) and Insomnia, as well as to explore the moderating role of stress between the said association, and whether the association remains the same in different age groups and gender groups or varies? A sample of 100 individuals, 50 male, 50 female, was collected purposively from the population of Karachi. The age range was 18 to 40 years divided into two groups 18 to 30 and 31 to 40. The study was conducted physically, and a cross-sectional research design was used. To get the scores on the said variables, three scales were used first was the GSRs-IBS and second was the PSQI, and third was the Perceived Stress Scale. Data was analyzed by using IBM SPSS 21. To analyze the results, descriptive statistics such as mean and frequencies were calculated, and to find gender and age group differences, t-test for independent samples and to find difference between marital statuses, one-way ANOVA were used respectively. Pearson product-moment correlation was calculated to find the relationship between the two variables and to analyze the moderation effect of stress macro process, by Andrew F. Hayes ' used. Results showed a significant correlation between GI and Insomnia, but no moderation effect of stress between them. No gender, age group of (18-30) and (31-40), family system and marital status differences were found on Insomnia.

Keywords: Gastrointestinal Disorder, Stress, Insomnia, Irritable Bowel Syndrome, GSRs, PSQI

Introduction

Insomnia is an irritating and disturbing sleeping condition that hinders the capacity of an individual to fall or maintain sleep which leads to fatigue and impairment during the day. In addition to having short-term and painful effects, chronic insomnia is linked to numerous chronic health problems such as mental disorders such as depression and anxiety, physical disorders such as cardiovascular diseases, obesity and gastrointestinal (GI) disorders. The body needs sleep to rest and replenish its functions that affect cognitive abilities, immune system, and health in general.

Insomnia-induced sleep disturbances may have serious health consequences and Irritable Bowel Syndrome (IBS) is one of the most notable disorders that are often associated with sleep deprivation. The symptoms of IBS include pain in the abdomen, bloating and changes in bowel movements such as diarrhea and constipation. It has been shown in many studies that patients with IBS usually have inadequate sleep rhythm, and it can even increase the degree of the gastrointestinal symptoms (Peppas et al., 2021; Lassmann et al., 2022).

It is assumed that both insomnia and IBS have common pathophysiology, which involves dysregulation of the gut-brain axis, which enables the two-way communication between the gastrointestinal system and the brain. Stress in this multifaceted network of communication is very important, because it was found that it is a driving force behind both gastrointestinal symptoms and sleep disturbances (Liu et al., 2025). The impact of psychological stress on gut motility, the enhancement of gut permeability, and the promotion of inflammatory responses (including the activation of the hypothalamic-pituitary-adrenal (HPA) axis and release of stress hormones) can then promote the onset and exacerbation of IBS. Furthermore, insomnia is a known predicate of chronic stress, which may cause a vicious cycle of sleep deprivation and worsen gastrointestinal problems, and gastrointestinal problems exacerbate the quality of sleep (Aziz et al., 2021).

The interplay between these two disorders accentuates the need to consider the two-way relationship between the two disorders particularly in stress and inflammation. Despite the growing body of literature that has identified the relationship between insomnia and GI disorders such as IBS, research on the mechanisms behind such relationships, especially how stress and inflammation contribute, is limited, especially in such places as Pakistan where cultural, lifestyle, and environmental conditions may modify the progression of these ailments (Salwen-Deremer and Ballou, 2022). Thus, the further insight into the gut-brain communication processes, and their interplay with stress might serve as an important contribution to the more appropriate management approaches towards the patients with insomnia and IBS.

Hypotheses

The hypothesis for the above can be framed as

H1: There is an association between Insomnia and Gastrointestinal diseases (GI).

H2: Stress plays a role of moderator in the relationship between insomnia and gastrointestinal disorders such as IBS.

H3: Females are more prone to insomnia as compared to males.

H4: Insomnia is prominent in age cohort (31-40) as compare to age cohort(18-30).

H5: There is a significant difference in all marital statuses regards insomnia.

H6: There is no significant difference between the individuals of both nuclear and joint family systems regards insomnia.

Literature Review

Insomnia is a developing social issue on a global level. Many studies have described that prevalence of insomnia has been steadily increasing in the last few decades with a remarkable increment in both developed and developing nations. As an example, a study carried out in the United States suggests that the rate of insomnia has grown to

19.2 percent in the period between 2002 and 2012 compared to 17.5 percent, with a high rate of this health problem observed among younger populations (Ford et al., 2015). Likewise, a slight rise in the symptoms of insomnia has also been found in Canada, as a decade after 2002, the prevalence of insomnia symptoms has risen to 17.1 percent (Garland et al., 2018).

Insomnia is also very alarming in Pakistan. The study that was carried out in Karachi has identified that approximately, 31.3 percent of the population experienced insomnia symptoms, with 30 percent of those respondents regularly reporting on the use of sleep aids (Kidwai and Ahmed, 2013). The levels of insomnia among the university students were alarmingly high and can be explained by the academic pressures of this demographic, as well as the social changes (Khan and Ullah, 2022). These results help to emphasize the increased importance of insomnia as a common issue in Pakistan and the necessity of a context-related research on its causes and consequences.

Insomnia and Gastrointestinal Disorders

The connection that exists between insomnia and gastrointestinal disorders, specifically Irritable Bowel Syndrome (IBS) has attracted a lot of attention within the scientific community. IBS is a functional gastrointestinal disease that is usually associated with the following symptoms; abdominal pain, bloating, and irregular bowel movements that may be aggravated by sleep disturbances. Research conducted by Elsenbruch et al. (1999) established that people with IBS had a lot more subjective sleep issues than those without the condition. On the same note, a study conducted by Vege et al. (2004) has shown that sleep disturbance individuals were found to be 1.6 times more likely to have IBS and that symptoms like diarrhea and heartburn were more prevalent.

The two way interdependence between sleep and IBS is long known and many researchers have proposed that the quality of sleep does not only aggravate the gastrointestinal symptoms but it might also contribute to the occurrence of IBS (Goldsmith & Levin, 1993). Also, a research conducted by Lackner et al. (2013) has identified the interaction between IBS, insomnia, and mental health such as depression and anxiety that are the comorbid conditions. This highlights the necessity of including insomnia as one of the factors in the management and treatment of IBS.

Stress and Its Effects

Stress is also highly acknowledged to be a major cause of insomnia as well as gastrointestinal diseases especially IBS. The stress stimulates the hypothalamic-pituitary-adrenal (HPA) axis releasing cortisol, which is a hormone capable of influencing gastrointestinal motility, enhancing gut permeability, and facilitating inflammation. These changes in physiology have the potential to aggravate the IBS symptoms (Aziz et al., 2021). Besides, insomnia is a significant precipitating factor of chronic stress because it causes dysregulation of sleep-wake systems, which, in most cases, leads to problems with falling or maintaining sleep.

There are a number of studies which investigated the moderating effect of stress on the relationship between insomnia and gastrointestinal symptoms. According to a review by Peppas et al. (2021), psychological stress affects the gut-brain axis, making

the gastrointestinal tract more sensitive, and serving as a cause of some conditions, including IBS. Moreover, it has been found that stress exacerbates the quality of sleep, and this state of affairs leads to further instability in sleep, which subsequently increases the intensity of gastrointestinal symptoms (Liu et al., 2025). This two-way interaction indicates that the management of insomnia and the IBS symptoms could be very important in dealing with stress.

Age, Gender, and Marital Status

The correlation between insomnia and GI disorders can also be different depending on the demographic factors age, gender and marital status. When it comes to age, studies have indicated that younger persons are more susceptible to insomnia with researchers registering that insomnia is more prevalent amongst people whose age range is between 18-24 (Ford et al., 2015). But the elderly, especially after 60 years of age might be more susceptible to developing chronic insomnia due to the age related alterations in the sleeping cycles.

The insomnia prevalence among the genders has also been generally reported, with researchers saying that women have a higher chances of being affected by insomnia than men. A meta-analysis conducted by Zhang and Wing (2006) discovered that insomnia is more prevalent in women and that hormonal alterations during menstruation, pregnancy, and menopause are the factors that result in gender differences. In their turn, the findings of a study carried out by Kawata et al. (2019) indicate that, though women might have more sleep disturbances, men have higher risks of sleep apnea, a disorder that causes sleep disruptions as well.

Marital status has also been found to have an impact on the quality of sleep with the studies showing that married persons are most likely to report higher quality of sleep as compared to unmarried or divorced individuals. Troxel et al. (2009) discovered that marital satisfaction and not marital status itself had a great influence on determining the quality of sleep. Besides, a study conducted by Kawata et al. (2019) was able to indicate that separated or divorced individuals have a high likelihood of experiencing symptoms of insomnia, probably because of the stress experienced with relationship dissolution.

Methodology

Study Design

This study adopted a quantitative approach, specifically using a correlational design, to explore the relationship between insomnia, gastrointestinal disorders (particularly IBS), and the moderating role of stress. A cross-sectional research design was utilized, which allowed for the collection of data at a single point in time, making it possible to examine the associations between the variables of interest.

Sample

The sample for this study consisted of 100 participants, purposively selected from the urban population of Karachi, Pakistan. The participants were evenly divided by gender, with 50 males and 50 females, ensuring a balanced representation of both genders. The age range of the participants was between 18 and 40 years, and the sample was further categorized into two age groups: 18-30 years and 31-40 years.

This division allowed for an analysis of potential differences in insomnia and gastrointestinal symptoms across different age groups. In addition, the sample included a mix of individuals from nuclear and joint family systems, as well as individuals with varying marital statuses (married, unmarried, and divorced), enabling the examination of how these socio-demographic factors might influence the relationship between insomnia and gastrointestinal disorders.

Measures

several validated measurement tools were employed to assess the key variables in this study:

Pittsburgh Sleep Quality Index (PSQI): The PSQI was used to measure the quality of sleep and identify the presence of insomnia. This scale consists of 19 self-reported items that assess various aspects of sleep, including sleep duration, sleep disturbances, and daytime dysfunction. The PSQI has been widely used and validated in various populations, demonstrating good reliability and validity (Kinman, 2025). A score above 5 on the PSQI is typically indicative of poor sleep quality, suggesting the presence of insomnia.

Gastrointestinal Symptom Rating Scale – Irritable Bowel Syndrome (GSRS-IBS): To measure gastrointestinal symptoms, the GSRS-IBS scale was used. This tool includes 13 items across five subscales—abdominal pain, bloating, constipation, diarrhea, and satiety—each rated on a 7-point Likert scale. The GSRS-IBS is a psychometrically sound instrument with high internal consistency and reliability, providing a reliable measure of gastrointestinal symptom severity (Schäfer et al., 2017).

Perceived Stress Scale (PSS): The PSS was utilized to assess the level of stress experienced by participants. This 10-item self-report scale measures how unpredictable, uncontrollable, and overloaded participants perceive their lives to be. It is widely regarded as a reliable measure of perceived stress and has been shown to correlate with physical and psychological health outcomes (Lee, 2012). The PSS allows for the identification of individuals with high stress levels, which is particularly important for understanding its role as a potential moderator in the relationship between insomnia and gastrointestinal disorders.

Procedure

Data collection was carried out through a structured survey administered to participants in person. After receiving informed consent from each participant, they were asked to complete the survey, which included demographic information and the three measurement scales mentioned above (PSQI, GSRS-IBS, and PSS). The surveys were distributed in various community settings within Karachi, ensuring a diverse sample of individuals. Participants were assured of their confidentiality and informed that their participation was entirely voluntary.

Results

Table 1 Socio Demographic Characteristics of Participants

Demographic Characteristics	N	%
Age		
18 To 30	50	50.0
31 To 40	50	50.0
Gender		
Male	49	49.0
Female	51	51.0
Family System		
Nuclear	50	50.0
Joint	50	50.0
Marital Status		
Married	45	45.0
Unmarried	52	52.0
Divorced	3	3.0
Widow	0	0.0

This table shows that the sample is equally distributed in the Age cohort, as this cohort is mainly for comparison regarding Insomnia and their equal distribution will lead to fair results, The sample regarding the family system is fortunately as equally distributed as for age, regarding Gender there is a slight difference of one %, Moreover in this sample, 52% are Unmarried, which constitute a slight majority in the sample regarding marital status.

Table 2 Inter – Correlation for Gastrointestinal Disorder (GSRs-IBS) and Insomnia (PSQI)

Variables	N	M	SD	1	2
1. GI	100	23.92	10.887	-	
2. PS	100	6.71	3.376	.397**	-

Note. GI: Gastrointestinal Disorder, PS: Pittsburg Sleep QualityIndexInsomnia.1=GI,2=PS.

N=100

**P<.01.

**. Correlation is significant at the 0.01 level (2-tailed). Table 2 showing that there is nearly moderate significant direct relation betweenGI: Gastrointestinal Disorder and PS: Pittsburg Sleep IndexInsomnia. at 0.01 levelP<0.05

Table 3 Inter – Correlation for Sub Scales Of Gastrointestinal Disorder (GSRs-IBS) and Insomnia (PSQI)

Variable	N	M	SD	1	2	3	4	5	6
1. PSQI	100	6.71	3.376	-					
2. Diarrhea	100	3.79	2.235	.272**	-				
3. Indigestion	100	6.60	3.384	.289**	.614**	-			
4. Constipation	100	3.46	1.992	.364**	.553**	.723**	-		
5. Abdominal Pain	100	6.12	2.941	.479**	.615**	.714**	.680**	-	
6. Reflux	100	3.95	2.143	.281**	.590**	.678**	.656**	.756**	-

Note.PS:PittsburgSleep QualityIndexInsomnia. 1 = PS, 2 = Diarrhea Syndrome, 3= Indigestion Syndrome, 4 = Constipation Syndrome, 5 = Abdominal Pain Syndrome, 6 = Reflux Syndrome.

N=100

**P<.01.

**. Correlation is significant at the 0.01 level (2-tailed). Table 3 shows that there is a significant correlation b/w each sub-scale of GI: Gastrointestinal Disorder and PS: Pittsburg Sleep Index Insomnia. P<0.05

Table 4 Moderating Role of Stress between Insomnia and Gastrointestinal Diseases (IBS) (N = 100)

Predictors	B	SE	t	p	ΔR ²	ΔF
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QST	2.75	1.06	2.58	.011*		
QPT	0.44	0.31	1.44	.154		
QST × QPT	-0.07	0.05	-1.49	.139	.019	2.23

Note: QST = Predictor, QPT = Moderator, QGT = Outcome

Significance levels: $p < .01^*$, $p < .05^*$

Table 4 shows the results of a moderation analysis testing whether **QPT** moderates the relationship between **QST** and **QGT**. The main effect of **QST** on **QGT** was significant ($B = 2.75$, $p = .011$), suggesting that QST positively predicts QGT.

However, the interaction term (**QST × QPT**) was **not significant** ($B = -0.07$, $p = .139$), and the change in R^2 due to the interaction was small ($\Delta R^2 = .019$). This indicates that **QPT does not significantly moderate** the relationship between QST and QGT in this sample.

Table 5 Independent Sample t test between Age Groups (18-30) / (31-40) for Insomnia.

	Age (18-30)		Age (31-40)		t(100)	P	Cohen's d
	M	S.D	M	S.D			
PS	6.480	3.333	6.940	3.437	-0.679	0.98	-0.136

Note:PS=Pittsburg SleepIndexInsomnia $P > 0.05$

Our hypothesis that Insomnia is prominent in the age cohort(31-40) as compared to the age cohort(18-30) has been rejected as Table 5 shows that the significance value is .98 which too much higher than the standard value of confidence α for social sciences which 0.05, as well as there is no such remarkable deviation as shown in this table through Cohen's d.

Table 6 Independent Sample t test between GenderGroupsMale/FemaleForInsomnia

	Male		Female		t(100)	p	Cohen's d
	M	S.D	M	S.D			
PS	6.591	3.785	6.823	2.964	-0.340	0.735	-0.068

Note:PS=Pittsburg SleepIndexInsomnia $P > 0.05$

Our hypothesis that Females are more prone to insomnia as compared to males has been rejected as Table 6 shows that the significance value is .735 which too much higher than the standard value of confidence α for social sciences which 0.05, as well as there is no such remarkable deviation as shown in this table through Cohen's d.

Table 7 Independent Sample t Test between Family Groups for Insomnia

Joint	Nuclear
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	M	S.D	M	S.D	t(100)	P	Cohen's d
PS	6.640	3.199	6.780	3.575	-0.206	0.837	-0.041

Note:PS=Pittsburg SleepIndexInsomniaP>0.05

Our hypothesis that there is no significant difference between the individuals of both nuclear and joint family systems regarding insomnia has been accepted. Table 7 shows that the significance value is 0.837, which is considerably higher than the standard alpha level of 0.05 for social sciences. This indicates that there is **no significant difference** between both groups. Additionally, there is no remarkable deviation as shown in this table through Cohen's d.

Table 8 Mean, Standard Deviation and One Way ANOVA of Marital Status.

Groups	M	SD	F	Sig	df
MARRIED	6.777	3.685			
UNMARRIED	6.442	2.979	1.94	0.15	2, 97
SEPARATED	10.33	4.163			

Note: M = Mean; SD = Standard Deviation; F = ANOVA F-value; Sig = Significance (p-value)

p > .05 → not significant

*p<.05

Table 9 Post Hoc Tukey's HSD Analysis for the variable of Insomnia (PSQI) between Married (N = 45); Unmarried (N = 52); and Separated/Divorced individuals (N = 3)

	MD	SE	Sig.
Married vs. Unmarried	0.34	0.68	.875
Married vs. Separated/Divorced	-3.56	1.99	.181
Unmarried vs. Separated/Divorced	-3.89	1.99	.128

* The mean difference is not significant at the .05 level.

A one-way between-groups ANOVA was conducted to explore the effect of **marital status on insomnia levels**, as measured by the **Pittsburgh Sleep Quality Index**

(PSQI). The participants were categorized into three marital status groups: **Married (n = 45), Unmarried (n = 52), and Separated/Divorced (n = 3).**

The assumption of homogeneity of variances was tested using Levene's Test and was found to be met, $p = .199$, allowing for interpretation of the ANOVA output under the assumption of equal variances.

The results of the ANOVA indicated that there was **no statistically significant difference** in insomnia levels across marital status groups, $F(2, 97) = 1.936, p = .150$.

Although the **Separated/Divorced group** showed the highest mean PSQI score ($M = 10.33$), suggesting higher insomnia symptoms, this difference did **not reach statistical significance** in the post hoc comparisons. The **Tukey HSD test** confirmed that none of the pairwise differences were significant (all $p > .05$). These findings suggest that **marital status does not significantly affect insomnia levels** in the current sample.

Discussion

This research was done to know whether either a psychological problem Insomnia and a physical problem Gastrointestinal Disorder (IBS) are associated with each other or not, as well as to see the vulnerability for gender groups, age cohorts, family structure as well marital status regarding Insomnia. For the assessment of insomnia and gastrointestinal vulnerability, two scales were used GSRS (IBS) scale and Pittsburgh Sleep Index and to assess stress, perceived stress scale were used.

It is found that both variables are significantly related to each other, having direct relation which means if insomnia triggers then IBS will also become severe, as we found in previous researches, as it is found that 74% of IBS not satisfied with their sleep (Goldsmith, G., & Levin., 1993). Similarly Elsenbruch et al . (1999) reported that

IBS

patient

has significantly more subjective sleep problems as compared to the non-IBS individuals.

The moderation analysis showed that insomnia has a strong direct relationship with gastrointestinal problems. The whole model explained about 17.8% of the variation in gastrointestinal problems. However, the effect of stress as a moderator was only 1.9% and was not statistically significant ($p = .1389$).

This means our hypothesis, based on the Biopsychosocial Model—which suggested that stress would moderate the relationship between insomnia and gastrointestinal problems—was not supported. The results show that stress does not have a significant moderating role in this relationship

Results indicated that age don't matter regarding insomnia as after the statistical analysis it revealed that there is no significant difference between age cohorts regarding Insomnia which ultimately means that IBS has also no significant difference between age cohorts, as both has direct relation.

It is found that it doesn't matter that what the gender is in terms of insomnia as results indicated that there is no significant difference gender groups in terms of Insomnia which negates the previous findings that Women complained insomnia more as compare to male ((Karacan et al., 1976; Bixler et al. 1979; Lugaresi et al. 1987; Weyerer and Dilling 1991; Hohagen et al. 1994), which ultimately means that IBS has also no significant difference between gender groups, as both has direct relation

Our assumption that family groups or systems doesn't matter regards insomnia as in

researches regarding insomnia and marital status we found that previous results indicate that having partner is sufficient good sleep health (Troxel et al., 2009) so its doesn't matter that either family is nuclear or extended/joint, what matter is that either they have a bed partner or not, after statistical analysis it has been approved, family systems has no significant difference regarding insomnia.

It is found that our hypothesis that there is a significant difference in all marital statuses regards insomnia is rejected as the results of the ANOVA indicated that there is no statistically significant difference in insomnia levels across marital status groups, $F(2, 97) = 1.936$, $p = .150$. which negates previous findings that presence of bed partner play healthy role in sleeps quality (Troxel et al., 2009), Marital harmony is linked with good quality of sleep as compared to marital dissolution(divorce/separated),(Prigerson et al., 1999).

Conclusion

The conclusion is that despite limitations it is established The conclusion is that IBS and Insomnia are significantly and directly related to each other, which means that if one increases then ultimately the second will increase too, and their is no significant difference for age cohorts as well as family and gender groups regards insomnia which leads to the assumption that IBS will also have no significant difference in them as IBS and Insomnia are directly related to each other, and In term of marital status unmarried have more healthy sleep as compare to marital status holder.

Limitations

The sample of this study was too small as compared to the population of Karachi, as it can give a little indication, but we cannot generalize the findings of 100 participants to the populations of 4 crores and changed. Second, it is observed that participants felt awkward about the statements of the GSRs(IBS) scale. Second, we relied only on the subjective reports about IBS.

Recommendations

Sample size should be adequate for the population size, in future it is recommended to take large sample.

Implication

This study's findings can help health practitioners regarding the treatment of IBS. According to the results, there is a probability that the person has comorbidity with insomnia, as both have a direct relationship. So practitioners have to consider and give importance to both in order to treat individuals and check whether IBS patients are suffering from insomnia too, as without screening, the treatment will be difficult.

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