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Gut Microbiome Dysbiosis Associated to Mental Health: Cognitive Functioning, Stress Resilience, Neuroticism and Quality of Life Affected by Gut-Brain Axis

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ABSTRACT

In recent years, the association between the Gut Microbiome Dysbiosis and Mental Health have been the target of interest for many researches as it has proved to affect the Brain through a bidirectional pathway between the brain and gut known as Gut-Brain Axis. The focus of this study is to evaluate the effects of gut related diseases on cognitive functioning, stress resilience, neuroticism and quality-of-life among the patients of gut microbiome dysbiosis. For this purpose, quantitative research was conducted through correlation research design. A sample of 42 patients was selected by purposive sampling technique from different hospitals of Lahore. To measure the variables Cognition Self-Assessment Rating Scale, Brief Resilience Scale BRS, The Big Five Inventory's Neuroticism Subscale and The World Health Organization's scale WHOQOL-BREF were administered. The results indicate p= .073 for C-SARS, p= .008 for BRS and p< .001 for BFIN that revealed not a significant relationship between Quality-of-life QOL and cognitive functioning, significant but negative prediction between QOL and resilience, as well as a negative significant relationship between higher neuroticism and lower QOL. The study had unveiled the correlation between gut dysbiosis and its ramifications on psychological health of patients and how they are affecting quality of life of the individuals. These results will lead to a better understanding of association between gut microbiome dysbiosis and cognition, resilience, and neuroticism to improve their mental and physical health.

Introduction

There are various microorganisms in the gastrointestinal tract or gut of humans that are helpful in the functioning of gut organs known as gut micro-biota. These gut microbiomes or micro-biota have effects on the different organs and systems of the body including brain, immune system, neurotransmitters, neurological pathways or neuroendocrine pathways and mental health through a bi-directional tract between gut and brain called as Gut- Brain Axis. (Mhanna et al., 2024)

Disruptions or alterations in the composition or working of the gut microbiomes that is referred to as Gut micro-biota Dysbiosis/ Gut Microbiome Dysbiosis can cause different negative consequences on psychological and physical health of individuals. The main neuronal pathway through which the brain and gut are connected and effecting the other systems in the body is through Vagus Nerve. (Verma et al., 2020)

Dysbiosis is a disruption in a microbiome, a community of microorganisms living together that coexist and interact with each other. Human bodies are home for different microbiomes, which are groups of microorganisms that live inside and they play a huge role in keeping them healthy. In a balanced microbiome, different microorganisms coexist in harmony, with no one type dominating the others. Dysbiosis is when the balance and variety of microorganisms gets disturbed, affecting how they work in the body. (*Dysbiosis*, 2025)

When there is a disbalance of gut bacteria it can lead to all sorts of digestive issues and Gastrointestinal (GI) including

- Bacterial Infections like H.pylori and C.difficile.
- Small Intestine Bacterial Overgrowth (SIBO).
- Inflammatory Bowel Diseases (IBD), like Ulcerative Colitis and Crohn's Disease.
- General Digestive difficulties, like Diarrhea, Constipation and acidity.

There is a connection between gut, microbiome, brain and other systems of the human body such as

- Immune System
- Nervous System
- Endocrine System (*Dysbiosis*, 2025)

Recent studies show how an imbalance in the gut microbiome (dysbiosis) affects things such as Cognitive function (thinking, memory, etc.) Resilience (how well we cope with stress) Neuroticism (tendency to experience negative emotions) Quality of life (overall well-being). By exploring these connections, we can better understand how the gut microbiome influences our mental health and daily life.

Cognitive Functioning

Cognitive functions incorporate with the mental processes that enable us to think, learn, remember, and problem-solve, including its essential parts such as memory, attention, executive functions, and language processing. (APA Dictionary of Psychology, 2018).

Resilience

Resilience is the process and product of effectively subsist with adverse or demanding life

experiences, exceptionally through mental, emotional, and behavioral pliability and adaptation to external and internal stipulations. Several factors influence the extent to which individuals cope effectively with adversities, most notable among them (a) how individuals perceive and interact with the world, (b) quality and accessibility of social resources, and (c) coping mechanisms (APA Dictionary of Psychology, 2018).

Neuroticism

Neuroticism, maybe the most complex health-applicable personality factor, involves a pattern of anxiety, fussing, moodiness, and negative feelings, as varied to a calmer, gratified, accomplished, and stable set of passions, responses, and social relations (Friedman.,

2019).

Quality of Life

To define Quality of Life QOL numerous approaches live. Karimi and Brazier (2016) put forward that there are approaches grounded on mortal requirements, private well- being, prospects, and phenomenological shoes. An affiliated literature on well- being distinguishes between approaches grounded on objective lists, preference satisfaction, sybaritism, flourishing, and life satisfaction. exemplifications of delineations of QoL are ‘‘a conscious cognitive judgment of satisfaction with one’s life’’ and ‘‘an individualities’ perception of their situation in life in the environment of the culture and value systems in which they live and in relation to their assertions, prospects, customs and business’’.

The Biopsychosocial model, initially introduced by Engel in 1977, has emphasized the intricate interplay between biological, psychological, and social determinants, demonstrating how the confluence impacts well-being. Engel argued that illness occurs not only due to physical reasons, but also due to a combination of effects at the minute particle, individual, and community levels. (Tanaka et al., 2011)

This idea showed how gut-to-brain signals affect symptoms, actions, and well- being. The connection between these systems works both ways: upward processes include the mind's emotional reaction to stress or trauma affecting gut health, and downward processes involve the gut's exposure to infection, inflammation, diet (Eriksson et al., 2015). Both social and mental factors (like stress in life, ways of dealing with problems, help from others, and mental health) and body functions (like movement, swelling, gut sensitivity, and gut bacteria makeup) greatly affect symptom. These factors can lead to poor health outcomes and diminished quality of life (Tanaka et al., 2011).

Significance

In the past researches there is a prominent lack of evidence that the stress resilience and neuroticism are affected by Gut Microbiome Disruptions. And most of the studies shave talked about the GI diseases and their relationship with the overall mental health or disorders but almost no literature found on psychological aspects of stress resilience and neuroticism in accordance with quality of life of patients suffering from GI diseases. The culturally specific study of Pakistan in this regard has also not been published which rises the need to understand this bi-directional communication of Gut and Brain in this specific population.

This research examines how imbalances in the gut microbiome may influence mental health through the gut-brain connection. It aims to understand how disruptions in gut bacteria relate to cognitive performance, the ability to handle stress, levels of neuroticism, and overall quality of life. Although earlier studies have noted possible links between gut health and psychological states, few have analyzed these aspects together in a comprehensive way. By filling this gap, the study seeks to uncover whether gut dysbiosis contributes to challenges in thinking skills and emotional regulation. The results could guide preventive measures and treatments, including nutrition-based or microbiome-centered strategies, to support mental well-being. This work also offers a more integrated perspective on how biological and psychological factors interact. The knowledge generated will be useful for experts in psychology, neuroscience, and healthcare. Ultimately, the research has the potential to improve personalized approaches to care and enhance quality of life.

Literature Review

Previous studies had shown quite significant associations between the Gut - Brain Axis and the Mental Health. In this research Gut dysbiosis was studied to explore its effects on the patients' cognition, resilience, neuroticism and quality of life. Studies given below had examined the above-mentioned variables separately.

Gao, Baumgartel, and Alexander (2020) published a scoping review and thematic analysis. They focused on studies with both humans and animals that explored how the gut, brain, and microbiome interact. The researchers searched PubMed and reviewed reference lists, ending up with 85 studies that fit their criteria. The findings showed that certain gut bacteria imbalances, known as dysbiosis, are linked to cognitive issues like memory problems and Alzheimer's disease. The review also found that stress, especially in hospital care, can make these problems worse. The researchers suggested that working to improve the gut microbiome could help protect or support brain health.

Wang et al., (2023) conducted a narrative review aimed to examine how gut microbiota contribute to individuals' ability to adapt to stress, known as resilience, and how disruptions in these microbial communities may be linked to neuropsychiatric disorders. This included studies involving animals and humans investigating the relationship between gut microbiome composition, stress responses, and mental health outcomes. This described that excessive stress could lead to changes in the central nervous system and increase the risk for disorders such as depression, post-traumatic stress disorder, and anxiety. Conversely, some individuals show resilience and adapt successfully to stress. It highlighted that resilience is shaped by complex interactions among brain circuits, the immune system, the blood-brain barrier, and the gut microbiome. In conclusion, analysis showed that gut microbiota influences the communication between the brain and peripheral systems, affecting neural functioning and behavior.

In 2021, Bear et al., in their narrative review, they explore how the microbiome–gut–brain axis may influence whether individuals develop anxiety or depression after experiencing stress. The authors focused on studies involving both animal models and humans to understand how gut microbiota are linked to emotional resilience. The review described that while many people experience stress, only some go on to develop mood disorders, while others remain resilient. This alteration was shaped by an amalgamation of biological, psychological, and environmental facets. The analysis highlighted evidence from animal research showing that stress can alter gut microbial communities, and these changes may affect mood and behavior. However, it was noted that while

preclinical findings are promising, evidence from human clinical studies is still limited and inconsistent.

An et al. (2024), conducted a mixed-methods study to identify how specific patterns in the brain–gut microbiome system are linked to psychological resilience and mental health outcomes. The target population consisted of adult human participants. Using a cross-sectional design, the researchers collected fecal samples to analyze microbiome composition and function and conducted multimodal magnetic resonance imaging (MRI) to assess brain structure and connectivity. Data integration with latent component analysis allowed the team to explore associations among microbial activity, brain signatures, and psychological symptoms. The results showed that individuals with higher resilience had lower levels of depression and anxiety, as well as more active bacterial gene expression linked to adaptation, metabolism, and anti-inflammatory processes. They also had increased levels of beneficial metabolites such as N-acetylglutamate and dimethylglycine. Brain imaging revealed stronger functional connections in reward and sensorimotor networks, alongside reduced volume and connectivity in areas involved in emotion regulation. The bacterial transcriptome profiles provided the most accurate classification of resilience levels, suggesting that the microbiome plays a central role in shaping mental health and stress adaptation.

In 2022, Houtz et al., performed a theoretical review, aimed to describe how the gut microbiome contributes to stress resilience in animals, how organisms adjust physiological systems to maintain balance under environmental challenges. The authors focused on wild animal hosts as the target population. They probe how microbiome responses fit into the four categories of the reactive scope model: predictive homeostasis (regular, anticipatory adjustments), reactive homeostasis (short-term responses to stress), homeostatic overload (excessive strain), and homeostatic failure (breakdown of regulation). The paper identified measurable aspects of the microbiome—such as microbial diversity, adaptability, and gene richness that could serve as indicators of chronic stress in animal hosts. The authors argued that these metrics hold promise for assessing health and resilience but have been underused in ecological research. At last, the review proposed that applying the reactive scope model to microbiome studies can improve understanding of how animals maintain resilience in unpredictable environments.

He et al. (2022), conducted a quantitative study. The objective of this research was to explore how genetic factors linked to diet and gut microbiome interact to influence neuroticism. The target population included over 300,000 adult participants from the UK Biobank cohort. The study used a cross-sectional design and analyzed genotype data to calculate polygenic risk scores (PRS) for dietary habits, diet composition, and gut microbiome features, drawing on genome-wide association study (GWAS) datasets. Neuroticism scores were assessed using 12 questions from the Eysenck Personality Inventory Neuroticism scale. Regression analyses evaluated the interaction effects between diet-related and microbiome-related genetic variants on neuroticism risk. The results revealed several significant interactions, including positive associations between protein intake and Bifidobacterium-related SNPs, as well as fat intake and Clostridia-related SNPs, indicating higher neuroticism risk. Conversely, greater consumption of fresh and dried fruit showed negative associations with neuroticism when interacting with certain microbial markers, suggesting a protective effect. Other findings showed positive interactions between vegetable consumption and specific gut bacteria such as Veillonella and Acidaminococcaceae.

In 2024, Yang et al., in a quantitative genetic study, explore whether specific gut bacteria have a direct, causal impact on neuroticism. The study used Mendelian Randomization (MR) and

Summary Data- Based Mendelian Randomization (SMR) techniques to evaluate genetic data that connects gut microbiota and neuroticism-related traits. The analysis was based on large-scale summary statistics from genome-wide association studies (GWAS) rather than individual-level data. The findings revealed causal relationships between 20 bacterial taxa and neuroticism, including key subdomains such as worry and depressed affect. Notably, a higher relative abundance of Ruminococcus gauvreauii was consistently associated with increased risk for neuroticism and its subcomponents (e.g., odds ratio = 1.04, $p < 0.01$). The study also identified CPSF1, a gene showing shared genetic associations with this bacterial genus in both brain and colon tissue. Moreover, Ruminococcus gauvreauii was linked causally to neurotransmitters such as glutamate and glutamine, which are known to influence mood and emotional regulation.

Park et al. (2021) conducted a cross-sectional study to examine how different aspects of neuroticism related to gut microbiota composition in a community sample. The target population included 784 Korean adults who provided both psychological assessments and stool samples for analysis. The researchers used the Revised NEO Personality Inventory to measure six facets of neuroticism—anxiety, angry hostility, depression, self-consciousness, impulsiveness, and vulnerability—and applied 16S rRNA gene sequencing to characterize gut microbial communities. The analysis showed that participants with higher anxiety and vulnerability scores had significantly lower microbial richness, indicating reduced diversity. Differences in beta diversity (variation in overall community composition) were also significant for anxiety, self-consciousness, impulsiveness, and vulnerability.

Valles-Colomer et al. (2019), administered quantitative research to examine how specific gut microbiome characteristics are linked to mental health, including quality of life and depression symptoms. The target population comprised adults from the Flemish Gut Flora Project (n = 1,054) with additional validation samples, totaling 1,070 participants. Using a cross-sectional design and metagenomic sequencing. The analysis revealed that butyrate-producing bacteria, especially Faecalibacterium and Coprococcus, were consistently associated with higher reported quality of life. In contrast, Coprococcus and Dialister were significantly reduced in individuals with depression, even after accounting for antidepressant use as a confounding factor. The authors applied a gut–brain module framework to identify microbial pathways with neuroactive potential and found that microbial synthesis of 3,4-dihydroxyphenylacetic acid, a dopamine metabolite, was positively correlated with better mental well-being. They also observed a role for microbial GABA production in depression. The study concluded that these findings provide population-level evidence that gut microbiota composition and neuroactive metabolic pathways are linked to mental health status.

Kim, H.-N., et al. (2018) conducted a cross-sectional observational study. The aim of this quantitative research was to examine how gut microbiota diversity and composition are related to adult personality traits. The study included a sample of 672 adults, and personality was assessed using the Revised NEO Personality Inventory, while gut microbial profiles were determined through 16S rRNA gene sequencing. Results showed that overall gut microbiota diversity was significantly associated with personality traits, although the differences were subtle. Specifically, individuals with high neuroticism and low conscientiousness had greater relative abundance of Gammaproteobacteria and Proteobacteria, respectively—groups of bacteria often linked to inflammation. In contrast, participants with high conscientiousness showed greater levels of butyrate-producing bacteria such as Lachnospiraceae, which are generally considered beneficial to gut health. The researchers concluded that personality may play a role in shaping gut microbial composition, and vice versa, that suggests a possible pathway within the brain– gut axis.

Research in 2016, by Kato-Kataoka et al., performed a clinical trial titled "Fermented milk containing Lactobacillus casei strain Shirota prevents stress-induced cortisol elevation and subjective fatigue." This was a double-blind, placebo-controlled study in which 100 medical students were given probiotic or placebo beverages for 8 weeks leading up to exams. For assessment The Brief Resilience Scale and salivary cortisol were used. Statistical analysis via ANOVA showed that the probiotic group had significantly lower cortisol levels ($p = 0.03$) and higher resilience scores ($p = 0.01$) compared to placebo. This trial gave evidence about the gut-brain axis's role in managing stress responses.

Conclusion

In all four variables such as cognitive performance, resilience, neuroticism, and quality of life. Gut dysbiosis is consistently linked to negative outcomes, according to the evaluated research. Reduced beneficial microbial taxa have been linked to worse quality of life, increased neuroticism, decreased psychological resilience, and worse cognitive function, according to a few cross-sectional and interventional investigations. It had demonstrated that interventions targeting the gut microbiome improved resilience. Similarly, it was observed that probiotic intake reduced neuroticism and negative affectivity. In terms of quality of life, previous record provided evidence that microbial modulation correlates with improvements in health-related well-being. But how these all variables combinedly, are affected by the disruptions in the Gut microbiota composition is still needed to be explore. These variables also seem to be connected. Higher neuroticism and lower resilience may worsen gut alterations brought on by stress, sustaining dysbiosis and further compromising wellbeing and cognitive performance. Restoring gut microbial balance, on the other hand, can promote resilience, lower neuroticism, and improve quality of life and cognitive function all at once.

Research Objectives

1. To probe the effect of Gut-Brain Axis on the mental health.

2. To investigate the association of resilience, cognitive functioning, neuroticism and quality of life with Gastrointestinal Dysbiosis.

3. To investigate that Stress resilience, neuroticism, cognitive functioning affect in patients with Gut Dysbiosis diseases.

4. To assess Gut Dysbiosis diseases effects on the quality of life of patients.

Hypothesis

H1: Gut-Brain Axis impacts mental health.

H2: Stress resilience, neuroticism, and cognitive functioning are negatively affected in patients with Gut Dysbiosis diseases.

H3: Gut Dysbiosis diseases affect the quality of life of patients.

H4: There is an association among resilience, cognitive functioning, neuroticism, and quality of life with each other.

Methodology

To evaluate the association of Gut-Brain Axis and Mental health in terms of cognitive functioning, resilience, neuroticism and quality of life among the patients of Gut Microbiome Dysbiosis quantitative research will be conducted through correlation research design. In this study the target population was the patients of Gut Microbiome Dysbiosis who were either admitted or from Outpatient Departments in the different hospitals of Lahore and were taking medications for gut dysbiosis. The sample was selected by purposive sampling technique to approach the patients of a specific disease. A sample of 42 patients whose age was 18 years or above were selected for this research. Both male and female patients were evaluated.

All the identified patients were assessed on the grounds of their cognitive performance, stress resilience, neuroticism and quality-of-life with the help of Cognition Self-Assessment Rating Scale (C-SARS), Brief Resiliece Scale (BRS), Big five Inventory's Subscale Neuroticism (BFIN) and World Health Organization's scale WHOQOL-BREF respectively.

After collecting data, it was then entered in IBM Statistical Package for the Social Sciences IBM SPSS for statistical analysis. Results were computed through the descriptive statistics to calculate the mean; standard deviation, and correlations to assess the association among the mental health outcomes, and linear regression to evaluate to what extent one variable predicts the other.

Inclusion Criteria

Patients of Gastroenterology with Gut Dysbiosis only were allowed to participate in the study whose age was 18 or more. Both male and female patients were evaluated. Not only the Indoor but also outdoor patients and patients who were not in hospital but taking medications for gut dysbiosis were contacted. No restriction of area, socioeconomic status, and marital status was enforced. Married, unmarried, divorced, and widowed could participate.

Exclusion Criteria

Patients with any physical disability were excluded from the sample. Those who were suffering from any other serious chronic biological disease or diagnosed with any other psychological disorder were also not included.

Ethical Considerations

American Psychological Association APA code of conduct was Ensured. Health protocol was followed in case of any time of need. Participants were apprised about the confidentiality of their given data. Participation in the study was completely voluntary. Participants were given the right to withdraw at any time from research. Informed consent was taken. No harm was attributed towards the rights and reputation of participants. Data was reported in the study anonymously. Respect for cultural distinction was observed.

Results

The research reviewed the Pakistani Gut Microbiome Dysbiosis patients who were on medications for the disease or admitted in hospitals and from the Outpatient Department of the different hospitals in Lahore. The review was taken on the effects of gut disruptions on the cognition, resilience, neuroticism, and quality of life among the patients. For this purpose, descriptive

statistics of scales, correlations between the scales and regression analysis for the variables was run the SPSS software.

Descriptive Statistics for all Scales

The following table had supported the hypothesis number 1 and 2, stated as Gut-Brain Axis impact the mental health and Stress resilience, neuroticism, cognitive functioning are negatively affected in patients with Gut Dysbiosis diseases respectively.

Table 1: ***Descriptive Statistics for all Scales***

Sr no.	Scales	Mean	Standard Deviation
1	CSARS	14.76	7.05
2	BRS	18.36	2.12
3	BFIN	26.48	3.20
4	WHOQOL-BREF	80.64	13.o4

Interpretation

On CSARS average, participants scored about 15 out of a possible range up to 33, suggesting a moderate concerns about their cognition. Scores vary quite a lot—from as low as 3 to as high as 33—which depicts that people's experiences differed widely. It measured how resilient people felt using the BRS. Most participants had a score of 18. On average, people scored around 18 out of a possible 24, showing a generally moderate level of resilience. Respondents scored about 26 out of a possible 32 on BFIN, suggesting moderate to fairly high neuroticism. Most scores fell between 26 and 28, showing that many participants saw themselves quite similar in this trait. Descriptive statistics of WHOQOLBREF measured, showed patients scored around 81 out of a possible higher score, which suggests most saw their well-being as moderate to good. Scores varied a lot from as low as 54 to as high as 113 which shows that people's experiences differed widely. Quite a few participants clustered around scores in the low 80s, while a few rated their quality of life much lower or much higher. The researcher had the complete information as no participant had left any item.

Correlation between the Scales

The hypothesis stated as, there is an association of resilience, cognitive functioning, neuroticism and quality of life with each other, had been proved by the following given table of correlation among these variables.

Table 2: ***Correlation between the Scales***

Variable Pair Correlation	(r)	p- value
CSARS - WHOQOLBREF	-0.626	< .001
CSARS – BFIN	+0.305	= .050
BFIN - WHOQOLBREF	-0,463	= .002

Interpretation

The above correlation has shown significant associations between the three scales of the study. Cognition relation with quality of life was negative and significant which means that higher

cognitive complaints are associated with lower quality of life while positive correlation of CSARS with neuroticism was also significant that indicates that greater the cognitive impairment higher will be neuroticism. While neuroticism and quality of life were negatively associated which revealed that higher the neuroticism the lower the quality of life of patients.

The other correlations with resilience scale and other scales with each other were not significant as the p-value was CSARS–BRS ($r = –0.215$, $p = .172$), BRS–BFIN ($r = +0.093$, $p = .557$), and BRS–WHOQOLBREF ($r = +0.287$, $p = .066$) but this trend is not significant.

Regression Analysis

All the hypothesis included third one stated as, Gut Dysbiosis diseases affect the quality of life of patients had been proved by the following regression analysis.

Model Summary

Table 3: ***Regression Analysis***

Statistic	**Value**
R	.719
R^2	.517
Adjusted R^2	.479
Std. Error of the Estimate	9.411

Interpretation

Results revealed, strong overall correlation between predictors and WHOQOL-BREF, about 51.7% of the variance in quality of life is explained by the cognition, resilience and neuroticism predictors. Adjusted $R^2 = .479$ this showed that it was adjusted for the number of predictors and still had substantial explanatory power.

ANOVA

Table 4: ***Overall Regression Model***

Statistic	**Value**
F	13.555
Sig. (p-value)	< .001

Interpretation

The overall regression model was statistically significant, as the value of $F(3,38) = 13.555$, $p < .001$. This means that, collectively, the CSARS, BRS, and BFIN reliably predict WHOQOL-BREF scores.

Coefficients

Table 5: ***Cognitive Performance***

Predictor	B (Unstandardized)	Beta (Standardized)	t	p
(Constant)	105.744	–	6.185	< .001
CSARS	- .881	- .477	+1.843	< .001
BRS	1.330	.216	-2.812	.073
BFIN	-1.379	- .338	-3.893	.008

Interpretation

The p- value of both Cognitive performance on CSARS and Neuroticism on BFIN were < .001, which depicts that both are the strong and moderate predictors of quality of life respectively, that was measured by WHOQOLBREF. Higher the cognitive complaints and neuroticism the lower will be the quality of life. The correlation of resilience with quality of life had a positive trend but was not significant because the p- value of resilience is > .001. This trend may indicate high quality of life with higher resilience.

Discussion

The objective of the research was to probe the Gut-Brain Axis and how it affects the psychological well-being of the patients who had Gut Microbiome Dysbiosis. Through the statistical analysis it was investigated that how the quality of life of dysbiosis patients was affected by cognitive functioning, resilience and neuroticism. However, it also evaluated the correlation between the cognitive performance, resilience, neuroticism, and quality-of-life.

The mean scores of respondents on C-SARS, indicated that people who are suffering from Gut Microbiome Dysbiosis tend to have moderate level of complaints about their cognitive performance. In a study by Dai et al., 2022, it was proved that Gut microbiome can alter the function of the central nervous system, thereby changing the behavior and cognition of the patients with dysbiosis. Neurochemical signals initiated by gut microbiome can be relocated from enteric nervous system to the central nervous system by way of the vagus nerve. Gut microbial dysbiosis also make different the expression of 5-hydroxytryptamine (5-HT), neurotrophic factors (e.g., BDNF), and N-methyl-d-aspartic acid (NMDA) receptor subunits in the hippocampus as well as myelin formation in the prefrontal cortex, that escorts to impaired social cognition. Such imbricating mechanisms suggested a significant role of the gut microbiota in the development of cognitive impairment.

While the mean of BRS, depicted that the patients were at a moderate level of resilience which means that they had not a satisfactory ability to overcome the stress in their current living conditions. Very few studies had investigated the resilience and its inner lying microbiota mechanism but its still unclear. But in recent research by Wang et al. (2023), the microbiota directly influences the interface between the brain and the periphery to affect the neuronal response which in turn affect the resilience.

Participant's score on BFIN revealed that they were a little being more neurotic, as some people cannot remain calm at the time of stress or was being more emotional and could be upset easily. According to Friedman (2019), neuroticism is linked to poorer health outcomes, particularly when health encompasses broader aspects such as psychosocial well- being and overall quality of life.

The score of the WHOQOLBREF revealed that the patients' quality of life was affected by the dysbiosis they suffered from. The overall score moderate to good level of quality of life but the respondents had shown varied responses. This means it depends on the person himself or herself that how he or she felt about his or her life and it's basic requirements. The biopsychosocial model explained that the biological changes in the gut and its social effects on the patients can lead to lower or even diminished quality of life (Tanaka et al., 2011).

Regression analysis showed the positive relation of quality of life with cognitive impairment but that was not significant. While indicated negative significant correlation with the resilience and neuroticism, which unveil the concept that higher the resilience is associated with lower quality of life and lower neuroticism depicts the higher level of quality of life. Drossman (1998) applied the biopsychosocial model specifically to gastrointestinal disorders, proposing that disease pathologic process involved the interaction between psychological, social, and physical domains, particularly through the enteric nervous system (ENS) and the central nervous system (CNS). and this is how gut and the brain are affected by each other as also supported by the results of this study.

As the first statement hypothesized was that Gut- Brain Axis GBA impact the mental health, this was proved as the results of this research uncover this as mentioned in table 7. This was also speculated that "alterations in the gut microbiome may play a pathophysiological role in human brain diseases including autism spectrum disorder, anxiety, depression, and chronic pain"by Mayer et al. (2014). It was further supported through the research on Cognitive Behavioral Therapy CBT and it's effects on gastrointestinal symptom improvement as stated by Jacobs et al. (2021), "patients with disrupted microbiota in gut had responded effectively to their treatment regime after having CBT sessions".

In the second hypothesis, it was stated that stress resilience, neuroticism, cognitive functioning are negatively affected in patients with Gut Dysbiosis diseases. This hypothesis had been confirmed as the results had revealed that these variables are correlated to each other in reference to the table 5 in results. Loughman et al. (2020), had quoted their findings that "there is a strong association between the composition of the gut microbiota in infancy and subsequent behavioral outcomes".

The third hypothesis states as, gut dysbiosis affect the quality of life of patients, had also been supported by the findings of this research given in the table 5. This was reported in the previous research by Rajilić-Stojanović et al. (2015), that the "symptoms of IBS were triggered through microbial fermentation" and as a result it affects the quality of life of gut dysbiosis patients. The quality of life of patients with disrupted microbiota were said to at risk of anxiety and depression with the prevalence percentage of 20% and 15% respectively in a systematic review on Depression and Anxiety in Irritable Bowel Disease (Neuendorf et al., 2016).

The fourth Hypothesis was reported as, there is an association of cognitive functioning, resilience, neuroticism, and quality-of-life and this was investigated through the regression analysis that had revealed that the cognitive functioning, resilience and neuroticism are all the predictors of Quality of life. And thus this also described how they are affected among the Gut Dysbiosis patients, reported in table 1, 2, 3, 4, and 5. As described by Valles-Colomer et al., 2019, that "in patients with gut dysbiosis their quality of life is being affected due to the disruptions in gut microbiome and its association to the brain and it's functioning".

The regression analysis had revealed that the cognitive functioning, resilience and neuroticism are all the predictors of Quality of life. And thus, this also described how they are affected among the

Gut Dysbiosis patients. The descriptive statistics of all the scales had predicted that there were moderate to high concerns about the psychological well-being and quality of life of patients. These results had supported the hypothesis of the research which were stated as Gut-Brain Axis impact the mental health, Stress resilience, neuroticism, cognitive functioning are negatively affected in patients with Gut Dysbiosis diseases, Gut Dysbiosis diseases affect the quality of life of patients, there is an association of resilience, cognitive functioning, neuroticism and quality of life with Gastrointestinal Dysbiosis.

To further support the findings there were very little researches on the variables that this study had focused. For future it is suggested to conduct more extensive research on these variables to inculcate the proper relationship between the Variables. This will be needed rigorously to understand the solely associations of the cognition, resilience, neuroticism and quality of life in order to probe the gut- brain axis and its psychological repercussions.

Limitations

The present study has some limitations that should be acknowledged. First, the research on this topic might infers a causal and effect relationship between the variables under study. Second, all the psychological tools were in English that might act as language barrier for the participants, majority of which were educated on middle level. Third, all the scales were self-assessment rating scale, that indicates that participants can manipulate their response and marked the one that doesn't predict their true self. And lastly, the research had a very small sample size of the same culture which can affect the generalizability of the findings on the larger populations or on other ethnic groups.

Future Directions for the Study

The research had given rise to several new ways to performs research on the same topic. As how to manage the good gut health to maintain a healthy gut-brain axis. How the people suffering from Gut Dysbiosis can improve their personality traits that are not explored in this study such as positive thinking, openness, conscientiousness, extraversion, Agreeableness, empathy etc. A comparative study can be designed to explore the difference between various personality traits among the healthy controls and the dysbiosis patients. How the gut- brain axis can alter a person ability to think and perceive his or her environment.

Conclusion

In conclusion this research had proved all the hypothesis are true, as the results confirmed that Gut- Brain axis do affect the mental health of the individuals. Second the cognitive functioning, resilience and neuroticism are affected negatively as shown by the responses of the participants via the statistical analysis. And at last quality of life of patients with higher neuroticism and low resilience had also been impacted negatively.

All these findings supports that the gut- brain axis has a significant effect on an individual's physical and psychological well-being. Further future directions for the research were also suggested in this research.

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