Evaluation Of Serum Interleukin-5 Levels Among Bangladeshi Obsessive-Compulsive Disorder Patients

By

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A thesis submitted to Department of Pharmacy in partial fulfillment of the requirements for the degree of Bachelor of Pharmacy

School of Pharmacy

BRAC University

May 2026

Declaration

It is hereby declared that

1. The submitted thesis represents my original work completed during my degree at BRAC University.
2. The thesis includes no material preliminarily published or authored by another party, except where properly cited with complete and precise references.
3. The thesis contains no material that has been accepted or submitted for any other degree or diploma at this or any other institution.
4. I have recognized all primary sources of assistance.

Student's Full Name & Signature

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Approval

The thesis entitled Evaluation of Serum Interleukin-5 Levels Among Bangladeshi Obsessive-Compulsive Disorder Patients submitted by Nisat Jahan Arthi (22346034) of Spring, 2026 has been approved as satisfactory in partial fulfillment of the requirements for the degree of Bachelor of Pharmacy on 7th May, 2026.

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Ethical Statement

The study stuck to the principle outlined in the protestation of Helsinki and the Guidelines of the Bangladesh Medical Research Council. Furthermore, the study protocol was approved by the Institutional Review Board/Ethical Committee of Southeast University, Dhaka, Bangladesh. Before participating, each existent entered a detailed explanation of the study's objects and handed written informed concurrence. Participants at any time could withdraw from the study without repercussions. Participants' anonymity and confidentiality were maintained throughout the study. Qualified healthcare professionals collected blood samples using aseptic techniques while ensuring participant safety and comfort. All research procedures compiled with national and international ethical standards to protect the well-being and rights of all involved human subjects.

Abstract

Obsessive-Compulsive Disorder (OCD) is a prevalent, chronic, neuropsychiatric condition increasingly linked to immune-inflammatory mechanisms. This study aimed to measure serum IL-5 levels in Bangladeshi OCD individuals and to examine their association with symptom severity. The study was conducted at Government National Institute of Mental Health (NIMH) & Hospital, Dhaka, Bangladesh. Total number of samples were 428 participants including 220 OCD individuals and 208 healthy persons. Diagnoses were confirmed using DSM-5 criteria. On the other hand, Y-BOCS evaluated symptom severity. A standardized laboratory procedure was followed to measure serum IL-5 levels. Statistical analysis was performed to compare the groups and assess correlation. Serum IL-5 level comparisons demonstrated slightly higher mean IL-5 levels in OCD patients than controls (2.43±1.19 pg/ml vs 2.17±1.12 pg/ml). A substantial difference was found (P=0.020). However, the correlation between serum IL-5 levels and Y-BOCS scores was weakly negative (r =-0.076) and not significant (P=0.262). In addition, substantial variability and overlap were observed between the two groups. In conclusion, although IL-5 levels are somewhat elevated in Bangladeshi OCD patients, no significant association with OCD symptom severity was identified. This research describes that IL-5's implication is limited as a single biomarker. This limitation highlights the need for further research involving multiple immune biomarkers.

Keywords: *Obsessive-Compulsive Disorder; Interleukin-5; Cytokine; Neuroinflammation; Yale-Brown Obsessive-Compulsive Scale; Biomarker*

Acknowledgement

To commence, I convey my sincere gratefulness to Almighty Allah for giving me the tolerance, strength, and occasion to complete and pursue the exploration work. I extend my profound thanks to my mentor, Dr. Md. Rabiul Islam for his valuable guidance, continious feedback throughout this study. His meaningful suggestion and encouragement were instrumental for this thesis completion. I further recognize my faculty members, laboratory staff, family members, and well-wishers for their unwavering support throughout every step of this journey.

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List of Acronyms

OCD - obsessive-compulsive disorder

IL-5 -Interleukin-5

BBB- Blood Brain Barrier

BMI- Body Mass Index

CSTS- Cortico-striato-thalamo-cortical circuit

ELISA- Enzyme-Linked Immunosorbent Assay

SPSS- Statistical Package for the Social Science

Y-BOCS-Yale-Brown Obsessive-Compulsive Scale

Chapter 1

Introduction

1.1 Obsessive–Compulsive Disorder

Obsessive-Compulsive Disorder (OCD) is a common, chronic, and neuropsychiatric condition defined by repetitive behavior and intrusive thoughts that result in distress and functional impairment (Stein et al., 2019). Symptoms of OCD often emerge in childhood, adolescence, or early adulthood. This disorder significantly impairs social, academic, and occupational functioning and therefore declines the overall quality of life (Stein et al., 2019). Globally, the prevalence of OCD stands approximately 2.3% (Soltan et al., 2023).These findings highlights a substantial percentage of the population experiences the disorder at some stage during their lifespan which is a significant public health burden.

OCD frequently emerges in childhood or adolescence. Evidence indicates that over 80% of the cases originated at the time of early adulthood (Stein et al., 2025).Data from World Mental Health Surveys shows that using Yale-Brown Obsessive-Compulsive Scale (Y-BOCS), most cases are categorized as mild (47%) or very mild (27.5%); 22.9% are classified as moderate, and only 2.7% reach the threshold of severe impairment (Stein et al., 2025).These statistics suggest that early intervention is crucial, as the absence of treatment in mild cases may lead to subsequent functional decline. Furthermore, the high rates of psychiatric comorbidity of OCD highlights that it is not an isolated disorder. A meta-analysis of 15,000 patients revealed 69 % of those with OCD present with at least one comorbid psychiatric symptom, such as mood, anxiety, or neurodevelopmental disorders (Sharma et al., 2021).

Although OCD is increasingly recognized as neuropsychiatric disorder, its comprehensive biological mechanisms are not yet fully explained. In addition to neurotransmitter imbalance and neural circuitry dysfunction, recent findings points a key role for immune-inflammatory process (Fabricius et al., 2022). However, research on specific cytokines is limited, especially those involved in Th2-mediated immune activity (Martino et al., 2020a).

Recent studies suggest that, besides neurotransmitter imbalance, a distinct component of immune-inflammatory dysregulation contributes to OCD pathophysiology (Alsheikh & Alsheikh, 2021). Although studies have not found uniform cytokine pattern in all adults, immune-related changes

may be more relevant in specific subgroups, such as those with early onset, neurodevelopmental conditions, or poor treatment response. The Th2 derived cytokine Interleukin-5 (IL-5) regulates eosinophil growth and differentiation. This cytokine is typically co-expressed with IL-4 and other chemokines, but we still lack it's biological role and serum concentrations in OCD cohorts (Alsheikh & Alsheikh, 2021).

Existing studies in OCD and related pediatric autoimmune syndromes have examined on other interleukins and chemokines. Therefore, IL-5 relationship with OCD remains largely uncertain (Alsheikh & Alsheikh, 2021). This knowledge gap is particularly relevant in the clinical context of Bangladesh. Early studies have already identified disruption in pro-inflammatory pathways like IL-1β, IL-6, and IL-17 among local patients (Sarmin et al., 2024). IL-5 could contribute to neuro-immune modulation relevant to OCD. This study aims to quantify serum IL-5 levels in Bangladeshi patients and explore it's potential as a novel biomarker in the disorder's evolving immunological framework by addressing these existing knowledge gap (Sarmin et al., 2024). Evidence shows elevated eotaxin-1 levels in OCD individuals compared to controls. Simultaneously, the examination of biomarkers such as IL-34, GM-CSF, and IL-17 as a potential diagnostic tools highlights the importance of studying IL-5. As other immune modulated alteration has been documented in other neuropsychiatric disorders, the examination of IL-5 may provide further insights into immune imbalance in OCD.

1.2 Definition

1.2.1 DSM-5 definition

In the DSM-5 TR, OCD is classified under the chapter Obsessive-Compulsive and Related Disorders where it is characterized by ongoing obsessions, repetitive compulsions or both that consume significant time (taking per day more than one hour) and provoke torture or functional impairment in social, occupational or other key life domains (American Psychiatric Association, 2013). DSM-5 further describes that these symptoms must not be related to substances of psychological effects, a medical condition, or another internal complaint.

In addition, it also gauge the persons sapience into the illogical nature of their obsessions (Huang et al., 2023). The DSM-5, reclassified OCD, moving it away from anxiety disorder and placed within other obsessive-compulsive affiliated diseases. This move exhibits OCD's neurobiological

basis and symptom pattern (Marazziti et al., 2015). The revised classification emphasizes OCD's unique features by differentiating its core symptoms. It describes obsessions as intrusive thoughts, beliefs, and images. On the other hand, compulsions are mental activities or repetitive behavior intended to ease discomfort (Marazziti et al., 2015).

1.3 Characteristics

1.3.1 Obsessions

Obsessions consists of persistent, unwelcome thoughts, impulses, or images that constantly intrude into person's mind (Giasuddin & Hossain, 2020).These intrusion clash with an individual's values and beliefs that cause disgust, guilt, or shame (Giasuddin & Hossain, 2020).Common themes of obsession include contamination, harm, sexual or religious blasphemy, and doubt about safety or responsibility (Jalal et al., 2023).Individuals usually recognize that these thoughts come from their own mind and try to repress or neutralize them (Giasuddin & Hossain, 2020).

1.3.2 Compulsions

Handwashing, cooking, counting, ordering, praying are examples of repetitive actions or mental processes that people are compelled to carry out in a strict or conventional way (Stein et al., 2019). These behaviors are carried out not for pleasure, but to reduce the obsession-related anxiety or to prevent feared events. However, the link between feared event and the ritualistic behavior is arbitrary (Abramowitz & Jacoby, 2014). Individuals with OCD exhibit the same pattern of compulsions such as washing, cooking, counting, ordering, praying even when their exact thoughts and specific fears may vary across different cultures (Gehlot et al., 2025).

1.3.3 Anxiety features

Obsession typically generates fear, anxiety, or a distressing sense of incompleteness, while compulsions function to alleviate this distress or avert anticipated negative outcome (Stein et al., 2019).Individuals with OCD commonly face pathological doubt, exaggerated sense of responsibility, feeling of guilt, shame and depressive symptoms (D. B. Riddle et al., 2023). As a result, a substantial portion of the OCD patient sample meets the threshold of clinically significant anxiety and depression (D. Riddle et al., 2023).

1.3.4 Functional impairment

OCD can cause substantial functional impairment that is time consuming. This functional impairment ultimately interferes with education, work life, family life and personal relationships (Stein et al., 2019). In adolescents and children, OCD can impair learning and social development. Similarly, Adults may experience unemployment, family conflict, and a diminished life quality (Stein et al., 2019).

1.4 Epidemiology

The estimated lifetime prevalence of OCD among the adult population is between 1.6% and 2.3%. Consequently, OCD is thus regarded as disabling condition with global impact (Abramowitz et al., 2009). Due to its high level of association with morbidity and comorbidity, OCD imposes a burden on individuals and the healthcare system worldwide (Abramowitz et al., 2009). However, the reported prevalence rate can vary based on region, cultural factors, and genetics (Dell'Osso et al., 2023). The World Health Organization (WHO) ranks OCD among the most disabling conditions for those aged 15-44, comparable to schizophrenia and bipolar disorder (Sarker et al., 2023). Women are at a higher risk than men, with global lifetime rates of roughly 1.5% for females and 1% for males (Fawcett et al., 2020). In Bangladesh, OCD impacts 1-3% of the people. This statistic aligns with the global estimation. The prevalence rate is 2% among children and adolescents. Specifically, contamination is the most common obsession and washing is the most frequent compulsion (Chowdhury et al., 2016). While the disease burden is substantial in countries like Bangladesh, the treatment rate is very low, emphasizing the need for recognition and care (Stein et al., 2025).

Table 1: Epidemiological Characteristics of OCD Globally and in Bangladesh

Region	Prevalence	Gender Ratio	Age of Onset	Notes
Global	1.6-2.3%	Female>Male	Adolescence	High Burden
Bangladesh	1-3%	Similar Trend	Early Onset	Low Treatment

1.5 Pathophysiology

Pathophysiology indicates the functional changes and abnormal physiological processes due to disease or injury and also provides insights into the clinical symptoms and diseases progression mechanisms (Witthöft, 2013). The pathophysiology of OCD involves various factors, including imbalance of neurochemical, dysfunction of neural circuit, genetic predisposition , and immune-inflammatory mechanisms (Sarker et al., 2023). A comprehensive conceptual model integrating these factors is essential to develop to understand the complexity of the disorder. In this context, studies on brain neurotransmitters such as serotonin and dopamine systems can provide the insights into how neurochemical imbalances lead to OCD symptoms. Specifically, dysregulation of the Cortico-striato-thalamo-cortical (CSTC) has an impact on OCD. These circuits modulated by serotonin and dopamine pathways and are responsible for the repetitive thoughts and compulsive behaviors. Additionally, neuroinflammation and autoimmune processes significantly to OCD pathogenesis by disrupting neuronal function and synaptic plasticity in key brain regions. Understanding this pathophysiological mechanism is crucial for developing pharmacotherapeutic interventions and personalized treatment strategies for individuals affected with OCD.

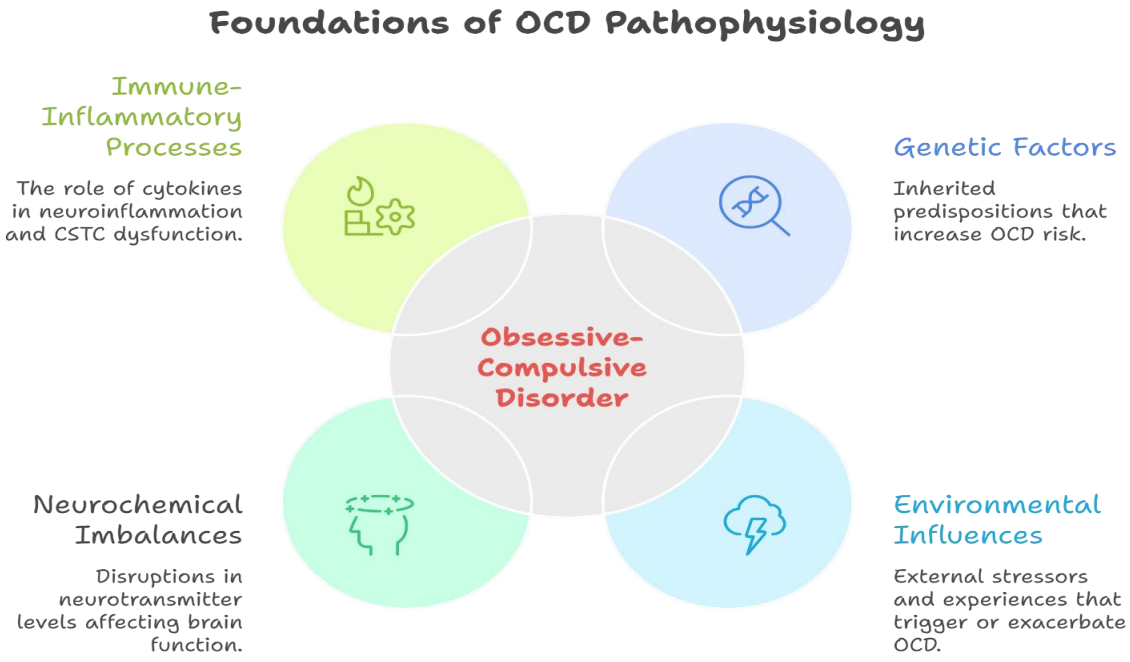


Figure 1: Integrated Pathophysiological Model of OCD.

This model explains the relationship between genetic, environmental, neurochemical, and immune-inflammatory mechanisms. It also highlights how cytokines modulate neuroinflammation and CSTC circuit dysfunction (Generated by using AI assisted tools).

1.5.1 Serotonin imbalance

Serotonin dysfunction has been considered the central component of OCD pathophysiology. Consequently, a serotonin reuptake inhibitor is considered first line pharmaceutical treatment (Gargano et al., 2023). However, direct evidence of serotonin dysfunction is limited, and dopamine and glutamate are increasingly considered as important contributors (Ting & Feng, 2008).

1.5.2 Cortico-striato-thalamo-cortical circuit

The origin of OCD is complex due to the intricate interaction between abnormal neuronal pathways and dysregulated psychopharmacology. Specifically, functional and structural abnormalities in the CSTC play a pivotal role in OCD pathophysiology (Pearlman et al., 2014).This circuit is widely regarded as the primary neuroanatomical basis for OCD.

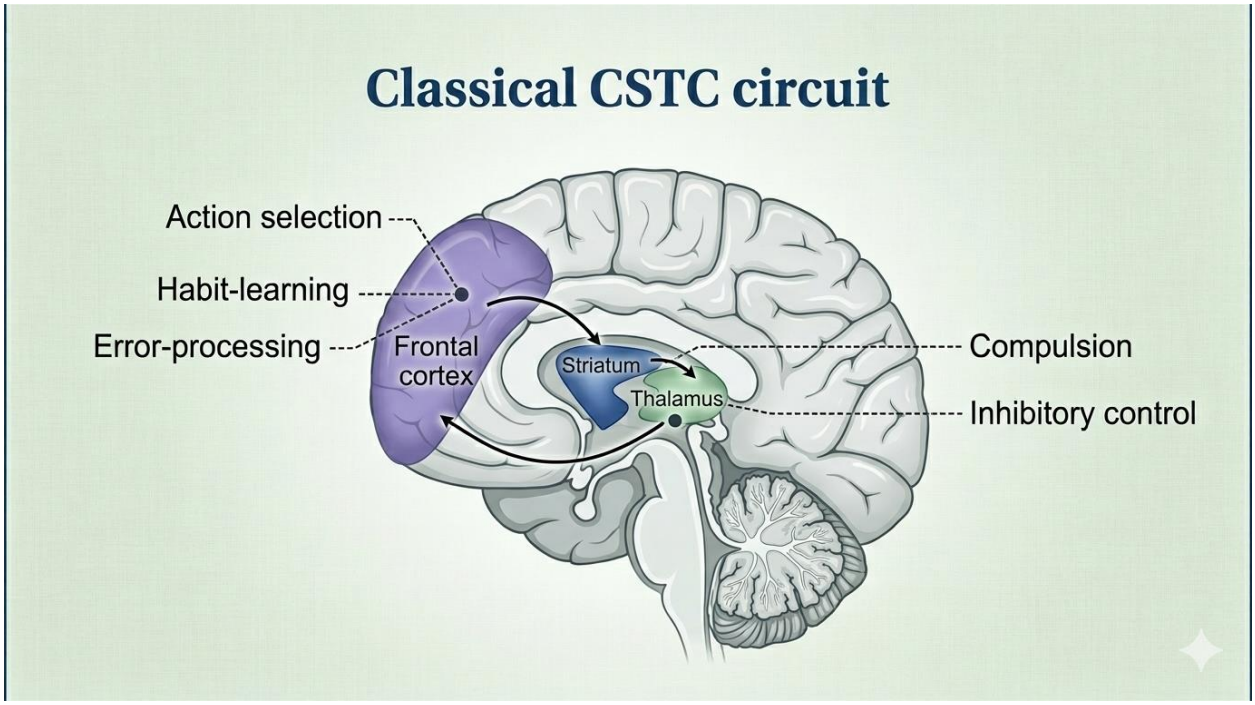


Figure 2: Classical CSTC circuit implicated in OCD.

The circuit depicts interactions among the frontal cortex, striatum, and thalamus forming a feedback associated with action selection, habit learning, and inhibitory control (Jijimon et al., 2026). (Image quality enhanced by using AI).

Hyperactivity and disrupted connectivity within a circuit comprising the orbitofrontal cortex, anterior cingulate cortex and striatum induce the repetitive thought action patterns typical of OCD patients (Pearlman et al., 2014).

1.5.3 Genetic factors

Genetic factors significantly heighten the vulnerability of individuals to OCD (Mahjani et al., 2021). However, genes alone cannot determine the development of this disorder (Ting & Feng, 2008). Factors such as stress, life experiences, and other biological factors may be involved in developing OCD. These factors contribute to the heterogeneity in clinical presentation and individual treatment response by affecting brain chemicals and inflammatory processes (Mahjani et al., 2021). Twin and family studies reveal a moderate genetic component. Several candidate genes, particularly serotonin signaling, glutamate transmission, and the regulation are associated with elevated risk (Mahjani et al., 2021).

1.5.4 Environmental factors

Environmental factors such as birth complications, early life difficulties, infections, and stressful events significantly contribute to OCD development. These factors interact with genetic factors and make individuals vulnerable to the disorder (Geller et al., 2021). Problems during birth such as maternal illness, long labor, low Apgar scores, or delivery problems are linked to later obsessive-compulsive disorder. Furthermore, these birth related disorders have been linked to anxiety or tic disorder related comorbid conditions (Geller et al., 2021). Recent studies suggest that dysfunction within glutamatergic system, a brain's excitatory pathway, may be associated with OCD. It can develop this disorder by affecting CSTC circuit (Gargano et al., 2023). The collective interactions of genetic vulnerability, environmental triggers, and neurobiological alterations facilitates the development of OCD. While genetic factors can influence the vulnerability to OCD, environmental stressors and adverse life experiences like childhood trauma significantly amplify the disorder (Chen et al., 2024).

1.5.5 Emerging inflammatory hypothesis

In recent times, growing recognition of the inflammatory hypothesis highlights that cytokine- mediated neuroinflammation may be a key contributor to OCD pathogenesis (Sarker et al., 2023).In particular, cytokines related to immune signaling can contribute to neuroinflammation via microglial activation in the CSTC circuit (Vallée et al., 2021).Research has revealed that elevated pro-inflammatory cytokines including IL-17, strongly correlate with OCD symptom severity. This results imply immune system involvement in onset, likely influenced by genetic factors, infections, autoimmune response (Sarker et al., 2023).These findings support studies identifying low inflammation and autoimmunity in some OCD patients. Such evidence helps researchers understand the immune changes and identify biomarkers of the disorder to develop new treatments (Dale et al., 2005).

1.6 Diagnosis

Primarily, the diagnosis of OCD is clinical. The psychiatric evaluation serving as the reliable method to identify the symptoms that meet the specific diagnostic criteria outlined in a standardized manual. A comprehensive clinical interview is necessary to understand the level of obsessions and compulsions, frequency, and the severity of the disease. As part of the diagnostic process, the examination of mental state of the patient's and their level of awareness regarding symptoms is important. A thorough examination is required to ensure that the patient has no underlying psychiatric and medical condition and to identify multiple disorder such as anxiety, depression, or tic disorder commonly involved in OCD (Mahjani et al., 2021).

1.6.1 DSM-5 criteria

The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, provides standards for recognizing obsessions and compulsions, differentiating them from other psychiatric disorders and identifying functional impairment resulting from the disorder**.** Accurate application of these criteria requires an additional diagnostic tool to determine symptom severity and treatment efficacy. DSM-5 sets OCD apart from other anxiety disorders by reclassifying it to a new class named Obsessive-Compulsive and Related Disorders to better understand its clinical feature (Abramowitz & Jacoby, 2014).

1.6.2 Yale–Brown Obsessive Compulsive Scale

The Y-BOCS is a popular used, clinician-administered scale that provides a quantitative measure for research and clinical practice to determine the severity of symptoms. This instrument standardized patient assessment and helps make comparisons across studies by exploring biological mechanisms, such as immune markers. In the context of the inflammatory hypothesis, researchers focused mostly on the use of this type of immune marker to reinvent diagnostic approaches and therapeutic interventions in OCD (Attwells et al., 2017).Accurate diagnosis can be improved by evaluating DSM-5 criteria in combination with a standardized scale, such as Y-BOCS, which guides treatment planning and tracks symptom changes over time (Alsudairy et al., 2023). A proper OCD diagnosis can be achieved by combining DSM-5 criteria and Y-BOCS standardized assessment tool. This combined approach enhances the diagnosis process, improves treatment planning, and allows effective tracking of symptom changes overtime (Alsudairy et al., 2023).

1.7 Cytokines and the Immune System

1.7.1 What are Cytokines?

Cytokines comprise small protein molecules that function as intracellular messengers, regulators of immune responses, controllers of inflammation, and producers of blood cells. Primarily, these small proteins are chiefly secreted by different immune cells, such as mast cells, macrophages, and lymphocytes. However, non-immune cells can produce these proteins in response to diverse physiological and pathological stimuli. The pleiotropic effect of cytokines can impact both innate and adaptive immunity by modulating cellular differentiation, proliferation, and survival (Ray, 2016). The interaction of various cytokines shapes the character of the immune response, from pro-inflammatory action mediated by IL-1β and IL-6 to anti-inflammatory actions regulated by IL-10. This dysregulation of cytokines, especially pro-inflammatory cytokines has been linked with neuropsychiatric conditions, including OCD (Sarmin et al., 2024). Balanced cytokine activity within these complex neuroimmune reactions can significantly maintain the neurological function and behavioral regulation (Belzeaux et al., 2017).

1.7.2 Groups of Cytokines

Cytokines are mainly categorized as pro-inflammatory and anti-inflammatory according to their immune response and functional properties, and they are further divided into Th1 and Th2 cytokines according to their roles in cell-mediated versus humoral immunity, respectively.

1.7.3 Pro-inflammatory (IL-6, TNF-α, IL-1β)

Interleukin-1β, interleukin-6, and tumor necrosis factor-alpha are the primary pro-inflammatory cytokines. These cytokines are vital for triggering and amplifying the immune response to pathogens. Chronic inflammation and tissue injury may result from their consistent activation (Bennett et al., 2018).

1.7.4 Anti-inflammatory (IL-4, IL-10)

An anti-inflammatory cytokine called interleukin-4 prevents pro-inflammatory signals, control excessive immune activation, reduces inflammation, supports immune tolerance, and tissue repair. Numerous chronic inflammatory diseases and neuropsychiatric disorders, including fibromyalgia. This highlights a dysregulation in the immune system's finely tuned homeostatic mechanisms (Nizzero et al., 2025).

1.7.5 Th1 and Th2 cytokines

Primarily, Th1 cytokines, exemplified by IFN-γ, IL-2, drive cell-mediated immunity against intracellular pathogens, while Th2 cytokines, including IL-4, IL-5, and IL-13 control humoral immunity, eosinophil activation, and allergic responses. Furthermore, Cytokines like chemokines, interferons, and growth factors are essential for recruiting immune cell, mounting antiviral defense, and facilitating tissue repair (Scapin, 2024).

1.8 How Cytokines Influence the Biological System

Cytokines function as signaling molecules that modulate gene expression and cellular activities in various physiological systems by attaching to particular receptors on target cells (Hadžimusić & Hadžijunuzović-Alagić, 2025).This signaling influence the nervous system. Peripherally produced cytokines have the ability to get through the blood brain barrier, regulate neuroendocrine process, and neurotransmitter metabolism, and ultimately impact behavior and brain function (Belzeaux et al., 2017) .Importantly, cytokines shape inflammatory processes by balancing pro-

inflammatory and anti-inflammatory responses. Pro-inflammatory cytokines amplify immune activity. Conversely, anti-inflammatory cytokines mitigate excessive activation and promote regulation (Fabricius et al., 2022). As a result, when an imbalance occurs between these two groups, chronic inflammatory diseases develop (Nizzero et al., 2025). In addition, cytokines can disrupt blood-brain barrier and cause neuroinflammation. This inflammatory state is linked to OCD symptoms through the overactivity of brain circuits (Fabricius et al., 2022) (Attwells et al., 2017).

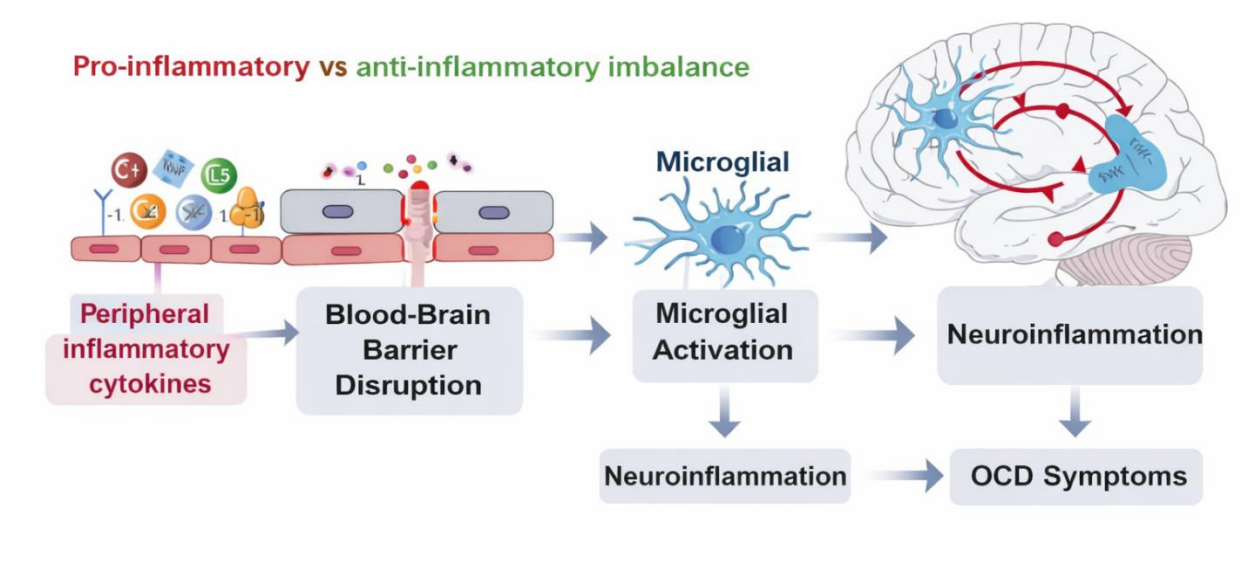


Figure 3: Cytokine mediated neuroimmune mechanism in obsessive-compulsive disorder.

Blood brain-barrier disruption may occur due to peripheral inflammatory cytokine, leading to microglial activation and neuroinflammation. This process can contribute to CSTC dysfunction and OCD development (Generated by using AI assisted tools). This model also illustrates the function of cytokines in neuroinflammation modulation and CSTC circuit dysfunction.

Peripheral immune activation is a major factor in the pathophysiology of some patients with obsessive-compulsive disorder. Pro-inflammatory cytokines, including IL-1β, IL-6, and IL-17 can inhibit the integrity of the blood-brain barrier by making it more permeable and enabling peripheral immune mediators to affect central nervous system functions (Fabricius et al., 2022).

This disruption activates microglial cells and releases additional inflammatory mediators, which causes neuroinflammation (Attwells et al., 2017). This inflammatory process can disrupt neuronal signaling and synaptic function within the CSTC circuit involved in OCD (Sarker et al., 2023).

Figure 3 shows how immunological dysregulation and brain circuits interact.

Inflammatory processes enable cytokines to compromise the blood-brain barrier's integrity, allowing immune cells to interact within the brain (Fabricius et al., 2022). Additionally, cytokines trigger immune signaling interactions in neuropsychiatric disorders by affecting neurotransmitter systems, such as serotonergic, dopaminergic, and glutamatergic pathways (Sarker et al., 2023).Pro-inflammatory cytokines can cause an imbalance in the central nervous system, resulting in symptom severity in OCD (Sarker et al., 2023). Moreover, cytokine-mediated stress response can regulate the hypothalamic-pituitary-adrenal-axis and promote neuroinflammatory changes (Hassamal, 2023).Therefore, high levels of inflammation increase the brain's response to stress, which subsequently enhances the brain and immune system crosstalk (Ravi et al., 2021). The constant interplay between cytokines and stress response further increases the immune dysfunction and regulate neurological and behavioral functions (Belzeaux et al., 2017).

1.9 Interleukin-5

T helper 2 cells, mast cells, and eosinophils all produce the crucial cytokine IL-5, which is important in the eosinophil differentiation, maturation, and activation (Bagnasco et al., 2017). This cytokine helps the body defend against parasitic infection and allergic reactions by regulating specific action against eosinophilic granulocytes (Pelaia et al., 2019). It's cell maturation, proliferation, antibody-secreting and cell differentiation activities suggest it's involvement in humoral immunity. This diverted role of IL-5 establishes it as an important regulator in both pathophysiology and immune surveillance (Than et al., 2023). Eosinophil survival and functional activity in peripheral tissue are supported by interleukin-5, which is essential for driving eosinophil proliferation and maturation within the bone marrow (Bagnasco et al., 2017). This mechanism facilitates the IL-5 role in immune regulation and diagnosis of eosinophil related inflammatory disease (Pelaia et al., 2019). The elevated levels of IL-5 are linked with alterations in central nervous system plasticity. These changes can contribute to psychiatric disorder like depression (Elomaa et al., 2012). Studies suggest that pathophysiology of a number of psychiatric conditions such as schizophrenia, bipolar disorder, anxiety disorders, and post-traumatic stress disorder, including OCD,

is significantly influenced by cytokine dysregulation most importantly the over production of pro-inflammatory cytokine (Sarker et al., 2023).

1.9.1 Biological Role

IL-5 is an essential cytokine that regulates eosinophils maturation, activation, proliferation, migration, and survival. It holds a vital role in eosinophils development and functionality in airway diseases (Buchheit et al., 2024).In addition to eosinophil regulation, IL-5 can control allergic reaction by influencing mast cell histamine release (Harvanová et al., 2023). This mechanism engages the broader immune response and regulates the B cell proliferation, survival, antibody secretion (Than et al., 2023). While IL-3 or GM-CSF contribute to early myeloid development, IL-5 affects the proliferation & differentiation of eosinophil within the bone marrow (Greenfeder et al., 2001). Due to the specificity of IL-5 to eosinophils, it has become a therapeutic target for the diagnosis of eosinophilia by targeting the IL-5 pathway (Roufosse, 2018). Monoclonal antibodies that neutralize IL-5 or block its receptor are used for the treatment by inhibiting eosinophil activity and mitigating inflammation (Roufosse, 2018). IL-3 & GM-CSF use share receptor subunit, whereas IL-5 uses a distinct signaling pathway through eosinophils, basophils, and mast cells, making it a targeted approach (Roufosse, 2018). The control IL-5 exerts over eosinophils gives it a unique physiological significance (Buchheit et al., 2024). IL-5 promotes the development and maturation of eosinophil-committed progenitor cells in the bone marrow and facilitates their release into the bloodstream by promoting eosinophil production (Roufosse, 2018). As an apoptosis inhibitor, IL-5 helps eosinophils stay longer in peripheral tissues. As a result, their effector functions in allergic inflammation and parasitic infections are enhanced (Pelaia et al., 2019). In eosinophils, this cytokine is bounded by a heterodimeric receptor composed of an α subunit and a βc subunit. This βc subunit is then shares signals required for eosinophil activity with IL-3 and GM-CSF receptors (Bagnasco et al., 2017).When IL-5 Overexpressed, a significantly rise in eosinophil and B-1 cell numbers occurs in Vivo. Conversely, a lack of f IL-5 gene activity or its receptor can significantly reduce these cell populations (Takatsu, 2011).

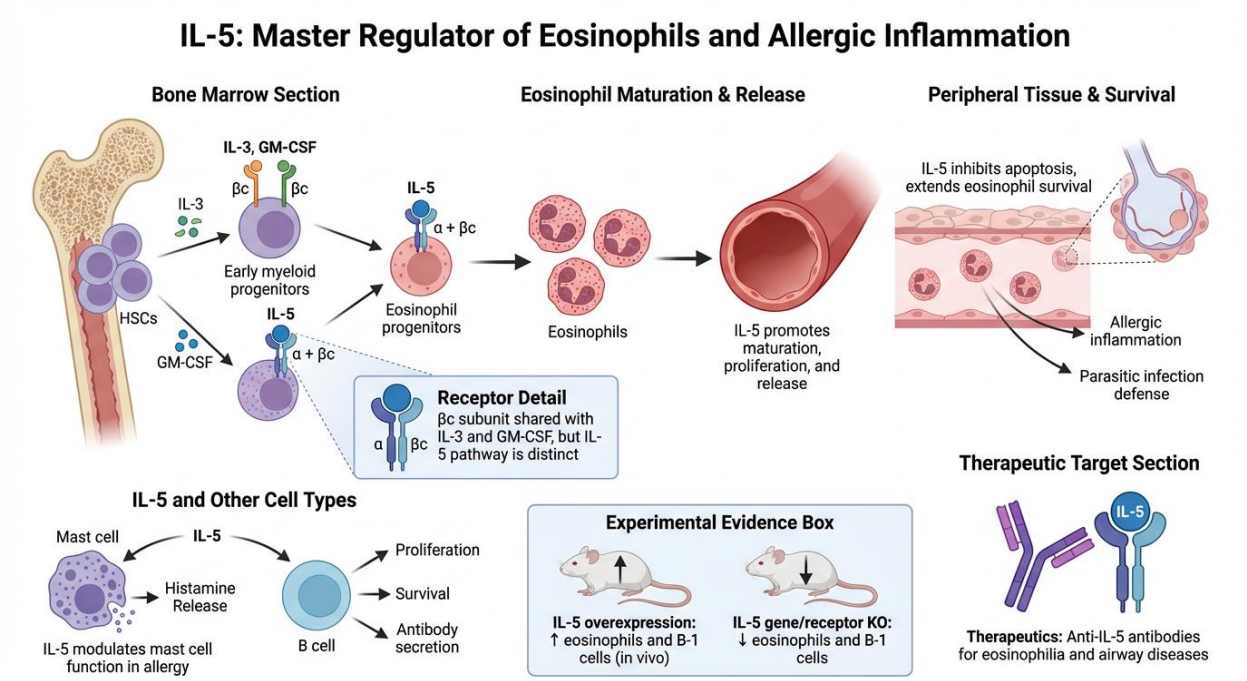


Figure 4: Biological role of IL-5 in immune response and eosinophil regulation

Eosinophil development, differentiation, maturation, and mobilization from the bone marrow to the peripheral blood are all regulated by IL-5. Besides, it inhibits apoptosis to prolong eosinophil survival in peripheral tissue. This mechanism enhances the function of eosinophil effector in allergic inflammation and parasitic infections. IL-5 also regulates proliferation, survival, and antibody of B cell and modulates mast cell histamine release. This process eventually contributes to a broader immune response.

1.9.2 Clinical Roles

IL-5 is essential for eosinophils activation and contributes to the disorder like asthma, allergic rhinitis, and other allergic reaction (Bagnasco et al., 2017). It drives inflammation and tissue damage in chronic inflammatory conditions and helps enhance eosinophil production and activity to fight against parasite infections in the body. It can contribute to developing neuropsychiatric disorders by affecting brain immune activity. Furthermore, elevated IL-5 levels can serve as a useful mechanism for disease monitoring and diagnosis of immune dysregulation in eosinophil

conditions (Roufosse, 2018). IL-5 controls eosinophils from their development in bone marrow and migration to the tissue and their activity there. This controlling factor explains its role in allergies and protecting the body from infections (Greenfeder et al., 2001).

1.9.3 Mechanism of Action

On the surface of target cells, primarily eosinophils IL-5 attaches to its receptor. This interaction activates intracellular signaling pathways that promote cell growth, differentiation, and activation (Pelaia et al., 2019). This binding trigger intracellular signaling cascades that drives cell proliferation, differentiation, and activation. It induces Janus Kinase 2 to become phosphorylated, which then causes Signal Transducer and Activator of Transcription 5 to become phosphorylated. Activated STAT proteins then bind to DNA and regulate the transcription of genes necessary for eosinophil (Pelaia et al., 2019). This mechanism forms a high-affinity receptor complex that facilitates transducing downstream signals, which then regulate eosinophil proliferation, differentiation, and survival (Greenfeder et al., 2001). This mechanism explains how IL-5 regulates the inflammatory response mediated by eosinophils (Bagnasco et al., 2017). The molecular development of IL-5 mediated eosinophil expansion and functional maturation can be further explained by various active transcription factors such as Pim-1 and Cyclin D3 (Pelaia et al., 2019). IL-5 is a dimeric glycoprotein that interacts to a particular receptor made up of an IL-5Rα subunit and a common βc subunit shared by GM-CSF and IL-3 receptors. These interactions lead to downstream signaling pathway (Pelaia et al., 2019). Moreover, via activating downstream pathways including phosphoinositide 3-kinase and mitogen-activated protein kinases, IL-5 activates Lyn and Raf-1 Kinases to inhibit eosinophil apoptosis and promote degranulation (Pelaia et al., 2019).

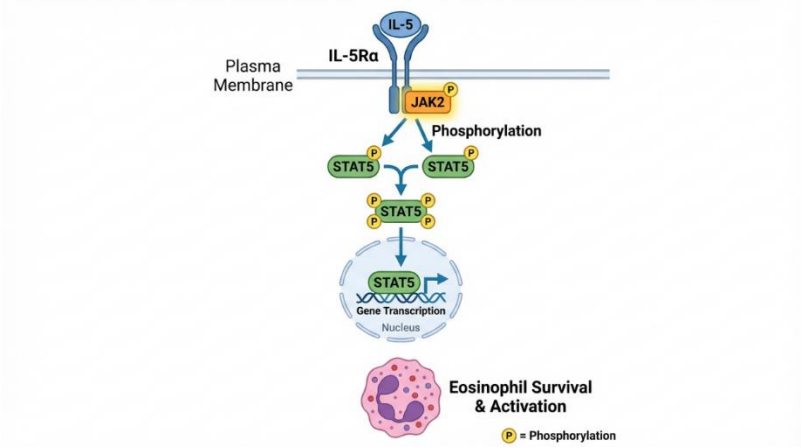


Figure 5: Mechanism of action of IL-5

Janus Kinase 2 (JAK2) is activated when IL-5 binds to its receptor (IL-5Rα) on the cell membrane. Signal transducer and activator of transcription 5 (STAT5) gets phosphorylated as a result, and it translocate to the nucleus to promote gene transcription. This molecular event contributes to immune regulation by activating eosinophils (Generated by using AI assisted tools).

1.10 Relationship Between Cytokines and OCD

A growing inflammatory hypothesis in the pathophysiology of OCD highlights the pivotal role of cytokines involved in dysregulation of immune system. Supported by various studies, this hypothesis indicate that individual with OCD possess higher serum levels of pro-inflammatory cytokines such as IL-1β, IL-6, and TNF-α that suggest potential neuroinflammatory component of the disorder(Fabricius et al., 2022). This dysregulation expresses the OCD symptoms by altering the neural circuit involved with OCD such as CSTC(Sarker et al., 2023).Increased level of interleukins such as IL-1β and IL-6 observed in OCD patients indicates the link between systemic inflammation and neurobiology of the disorder (Sharma et al., 2021).Cytokines, including IL-5, impact the basal ganglia, and frontal cortex activity, areas involved in OCD by influencing central nervous system process like synaptic plasticity, neurogenesis, and neuromodulation (Elomaa et al., 2012). Results indicate that OCD expression and progression are significantly influenced by elevated levels of inflammatory markers arising from immune system dysregulation (Sarker et al., 2023). Studies have identified the involvement of pro-inflammatory cytokines with pediatric and adult OCD patients, although their role is still under investigation (Fabricius et al., 2022). CSTC circuit combined with activated microglia supports a neuroinflammatory hypothesis in OCD that extends beyond the basal ganglia involvement (Attwells et al., 2017). Moreover, chronic peripheral inflammation can disrupt the blood-brain barrier through the action of elevated pro-inflammatory cytokines. This disruption triggers inflammation in the central nervous system and alteration of neurotransmitter systems, including serotonin glutamate, and dopamine (Sarker et al., 2023). This continious inflammation leads to neuronal damage and dysfunction in vulnerable brain regions associated with the pathophysiology of OCD. Consequently, focusing on inflammatory pathways through immunomodulatory therapies can be a promising avenue for novel therapeutic intervention in adult OCD, supplementing traditional pharmacotherapy symptom management (Attwells et al., 2017).

Table 2: Summary of cytokines implicated in obsessive-compulsive disorder.

Cytokine	Role	Evidence in OCD	Key Findings
IL-1β	Pro-inflammatory	Increased	Linked to symptom severity
IL-6	Pro-inflammatory	Elevated	Neuroinflammation
IL-17	Pro-inflammatory	Altered	Immune dysregulation
IL-5	Th2 Cytokine	Underexplored	Potential Biomarker

1.11 Inflammatory Hypothesis of OCD

Research indicates that immunological dysfunction, specifically an increase in pro-inflammatory markers, is a significant factors in the development of OCD (Vallée et al., 2021). Studies suggest that OCD is linked with increased serum or plasma concentration of various pro-inflammatory cytokines (Gray & Bloch, 2012). This includes interleukins such as IL-2, IL-4, IL-6, IL-10, and TNF-α, which contribute to systemic inflammation during the pathogenesis of the disorder (Fineberg et al., 2019).This inflammatory process may trigger the neuroinflammatory pathology of OCD by activating microglial within the CSTC circuit (Burchi & Pallanti, 2019). Some cases support the connection between pediatric OCD and autoimmune response triggered by streptococcal infections associated pediatric autoimmune neuropsychiatric disorders. This process involves anti-basal ganglia antibodies and subsequent neuroinflammation (Monteiro & Feng, 2016). The active inflammatory model influences the progression of OCD, with findings support that immunomodulatory treatment can alleviate OCD like neuropsychiatric symptoms (Sethi et al., 2019). As the literature regarding cytokine levels in OCD patients is conflicting, further investigation is needed for understanding role of immune dysregulation in the specific subgroups where autoimmunity is triggered by a pathogenic agent (Raposo-Lima et al., 2021). In addition to recognized inflammatory markers, imbalance in dopamine and glutamate dysregulation has also been linked to the OCD pathophysiology (Marinova et al., 2017). This comprehensive view indicates that both neurotransmitter imbalance and neuroinflammatory process contributes to the complex etiology of OCD (Sultania et al., 2024). A precise link between particular immune effector molecules and OCD

must be established because population techniques vary (Martino et al., 2020a). Recent literature proposes the potential existence of an autoimmune OCD subgroup. In this subgroup, autoimmune responses are triggered by infections that lead to increased pro-inflammatory cytokines and generation of autoantibodies that target specific brain regions (Endres et al., 2022). This autoimmune response may develop monocytes and CD16+ monocytes, resulting in enhanced innate immune surveillance (Vallée et al., 2021). For developing targeted immunomodulatory interventions, understanding the contribution of inflammatory mediators such as interleukin- 5 is crucial (Attwells et al., 2017). Accordingly, the purpose of this study is to investigate serum interlukin-5 levels in Bangladeshi patients with OCD to assess its potential role as a biomarker and to understand the inflammatory hypothesis within south Asian context. This study seeks to ascertain whether there is a difference exists in serum IL-5 levels between OCD patients and controls within the Bangladeshi population by testing the alternative hypothesis(h1). This study investigates the correlation between IL-5 level and OCD symptom severity as measured by (Y-BOCS) to evaluate the diagnostic efficacy of IL-5 within the specific demographic (Hossain et al., 2025). Furthermore, this study advances our comprehensive understanding of the immune mediated mechanisms underlying OCD. This understanding can be helpful for making personalized therapeutic strategies based on immunogenetic profiles.

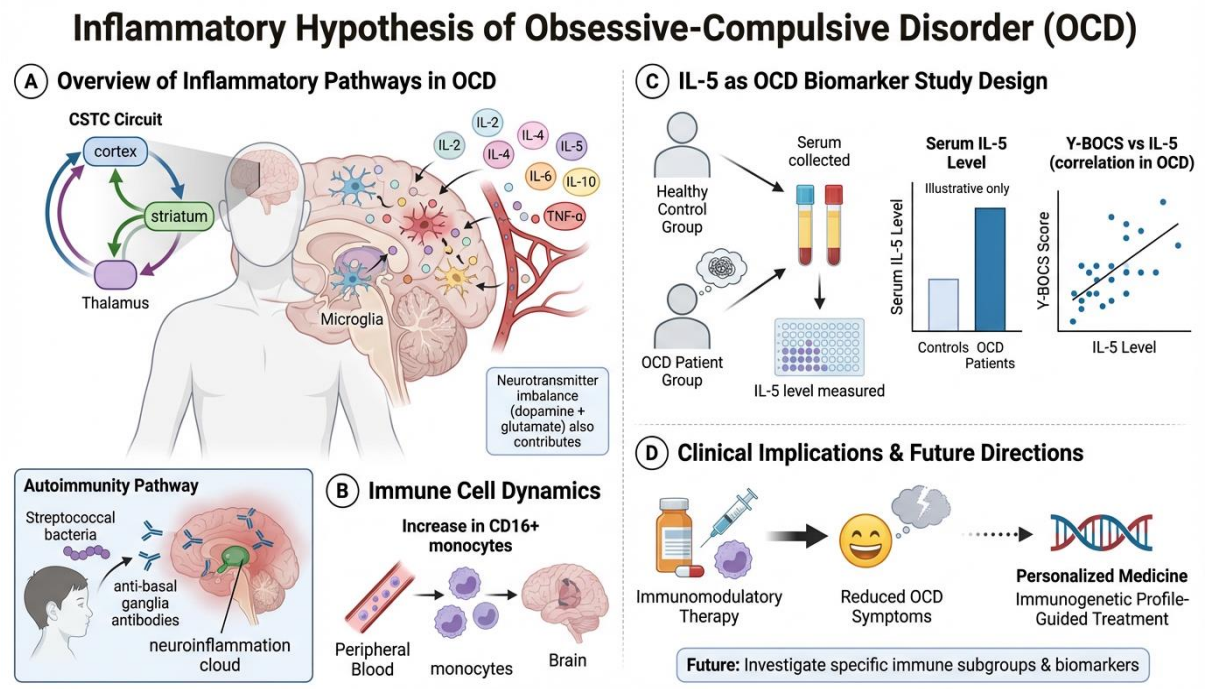


Figure 6: Inflammatory hypothesis of OCD and proposed role of IL-5.

(A) Peripheral inflammatory cytokines such as IL-1β, IL-6, TNF-α, and Th2 cytokines such as IL-5 may disrupt the blood-brain barrier that leading to microglia activation and neuroinflammation. This imbalance then contributes to the dysregulation of the CSTC circuit. Neurotransmitter imbalance then further contributes to disease pathology. (B) Immune cell imbalance dynamics such as increased peripheral monocytes may influence brain inflammation. The production of anti-basal ganglia antibodies may also contribute to autoimmune mechanisms in a subset of patients. (C) A comparison of serum IL-5 levels between OCD patients and controls and correlation with clinical severity. (D) Clinical diagnosis illustrates the potential of immunomodulatory therapies and personalized medicine approach based on immune profiling.

1.12 Possible Role of Interleukin -5 in OCD

Though there is a relationship between general inflammatory markers and OCD, the role of IL-5 in OCD has been untouched. Therefore, Investigation is required to explore this novel immune pathway (Martino et al., 2020a). This study fills the research gap by examining serum IL-5 levels in Bangladeshi OCD patients, in order to identify the contribution of cytokine in the disease's pathophysiology within this underrepresented population. This study aims to provide the link between immune mediated mechanisms and OCD patients in this demographic by comparing serum IL-5 levels in OCD patients and healthy individuals (De Oliveira et al., 2021). This finding may clarify the contribution of T-helper 2 immune response and the Th1/Th2 balance, as IL-5 is a crucial Th2 cytokine that controls the activation and differentiation of eosinophils (Elomaa et al., 2012). Although many studies emphasize Th1 pro-inflammatory cytokines, increasing evidence suggests that an imbalance between Th1 and Th2 pathways is linked with psychiatric conditions. This Th1/Th2 imbalance is particularly relevant in conditions where inflammatory mediators that promote neuroinflammation, such as cerebral palsy and autism spectrum disorder a (Than et al., 2023). Increased serum levels of IL-5 have been linked to an increased risk of many brain-related illness. This research may possibly explain IL-5's function as a peripheral indicator of inflammatory activity in the nervous system (Elomaa et al., 2012). Beyond well-known pro-inflammatory cytokines like IL-1β and IL-6, investigating the role of IL-5 in OCD may further understanding of the disorder's immunopathogenesis (Sarmin et al., 2024).Furthermore, the variability in IL-5 levels may correlate with different clinical presentation and treatment responses in OCD, which offers the potential for personalized medicine approaches. Since higher levels of this cytokine have been

linked to an increased risk of depressive illness, more research is needed to clarify the relationship between IL-5 and psychiatric disorders (Elomaa et al., 2012). Earlier studies in Bangladesh have investigated other cytokines such as GM-CSF, IL-17, eotaxin-1, and IL-34 and found significant differences compared to controls (Hossain et al., 2025). Therefore, examining IL-5 levels could further define the immunological profile of Bangladeshi OCD patients. It could also identify the novel inflammatory pathways specific to this population or help to understand the immune mediated OCD mechanisms.

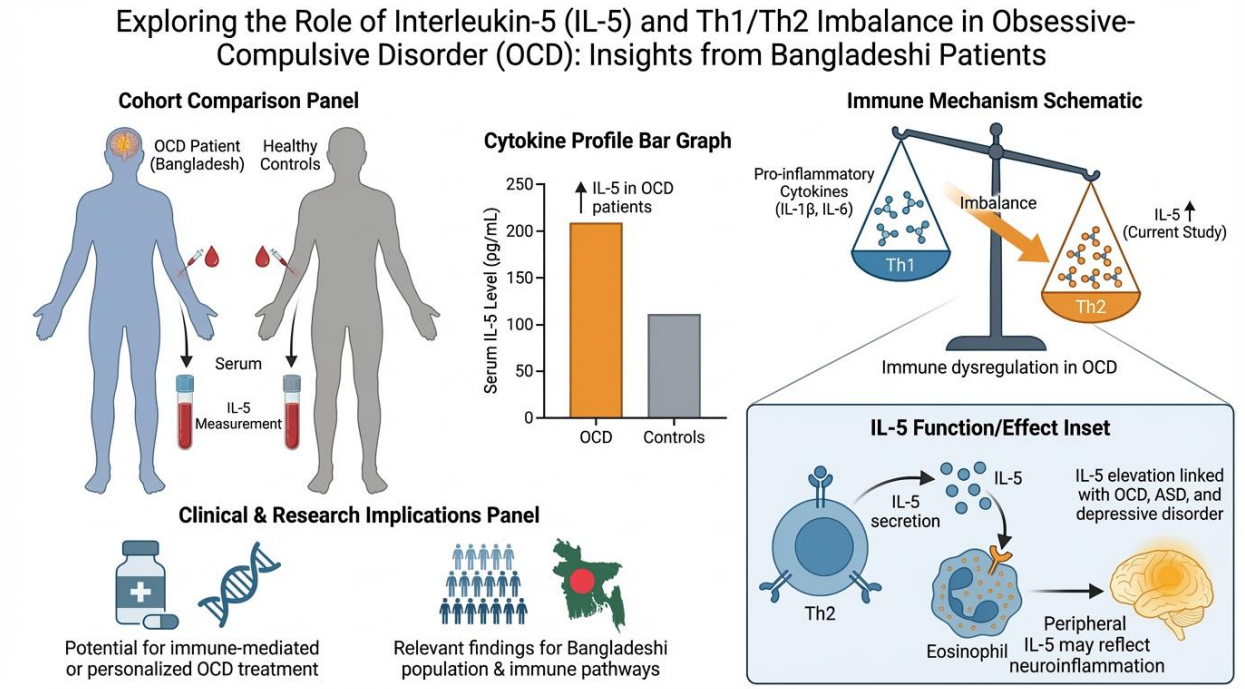


Figure 7: Proposed role of IL-5 and Th1/Th2 imbalance in obsessive-compulsive disorder (OCD) among Bangladeshi patient.

The cohort comparison panel explains serum collection from OCD patients and healthy control for IL-5 measurement. The cytokine profile bar graph shows how the group's serum IL-5 levels differ from one another. The immune mechanism schematic represents the imbalance between the Th1 and Th2 cytokines where IL-5 acts as a key Th2 cytokine and contributes to immune dysregulation in OCD. The IL-5 function/ effect inset describes IL-5 function in eosinophil activation and its potential role as a peripheral marker of neuroinflammation. The clinical and research implications

panel demonstrates the immune-mediated mechanism and personalized treatment approaches in OCD.

1.13 Research GAP

Although increasing evidence supports immune dysregulation in OCD, pro-inflammatory cytokines such as IL-1β, IL-6, and TNF-α are the primary focus of current studies (Chen et al., 2024). Conversely, researchers have given relatively minimal attention to the Th2 associated cytokine Interleukin-5. Furthermore, recent studies have focused on western populations, that limits the data availability for South Asian countries like Bangladesh. Genetic, environmental, and immunological differences make the lack of region-specific research a critical gap (Hossain et al., 2025). Therefore, studies on IL-5 cytokines in Bangladeshi OCD patients are crucial to understand their role in neuroinflammation and their potential as a biomarker.

1.14 Rationale of the Study

This research is to shed light on the role of neuroinflammation to the pathogenesis of psychiatric disorder and examine the function of IL-5 in the Bangladeshi population. Existing analysis of inflammatory markers in OCD report inconsistent findings; for example, a multivariate meta-analysis of peripheral cytokine levels detected confounding factors such as age at onset and variations in measurement methods but found no overall differences (Chen et al., 2024).

Therefore, a targeted study of particular cytokines such as IL-5 in well-defined group, such as the Bangladeshi population is recommended to identify the potential association and reduce the heterogeneity seen in broader studies. This targeted approach helps to understand the immunological dysregulation in OCD. This process focuses on specific cytokines rather than general inflammatory markers involved in neuroinflammation. As research on biomarkers for psychiatric disorders is limited in South Asia and specifically in Bangladesh, the purpose of this study is to close the knowledge gap regarding the inflammatory hypothesis in OCD. This study aims to provide culturally relevant data on the pathophysiology of OCD by focusing on a specific cytokine within an underrepresented population, bridging a gap in studies on Western population. Earlier studies in Bangladesh investigating other inflammatory markers like GM-CSF, IL-17, eotaxin-1, and IL-34 in OCD patients reported significant alterations (Hossain et al., 2025) (Sarker et al., 2023). In Light of these findings, assessing IL-5 levels in Bangladeshi OCD patients could distinguish the

immunological profiles and identify unique inflammatory pathways specific to this population (Sarker et al., 2023). The potential role of IL-5 in immune-mediated pathophysiology makes it a key target to bridge this literature gap (De Oliveira et al., 2021).

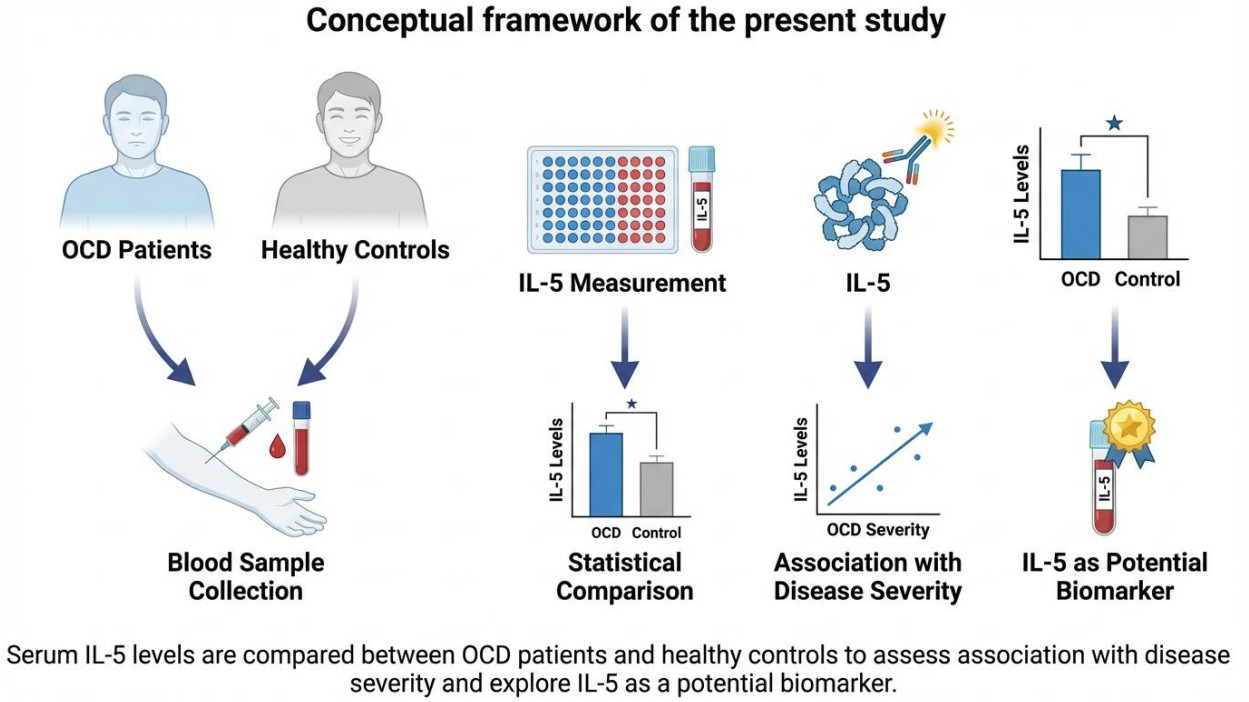


Figure 8: Conceptual framework of the present study

This model compares the serum IL-5 level between Individual with OCD and control. It also explains the statistical analysis of IL-5 levels and their association with disease severity, highlighting its possible role as a biomarker in OCD (Generated by using AI assisted tools).

Evidence from previous studies indicates that in conditions like schizophrenia where cytokine imbalance such as dysregulation of IL-10 is linked with severity of symptom. Similarly, these findings may highlight IL-5 as a possible biomarker for intensity of OCD (Bharali, 2024). Therefore, discovery of such a specific inflammatory marker is essential for enhancing therapeutic accuracy in ethnically diverse population. In order to differentiate OCD from a more widespread immune response, this study will assess whether aberrant IL-5 levels contribute to the pathogenesis of OCD in Bangladeshi patients. This investigation also extends prior research in major depressive disorder by evaluating serum IL-12 and IL-4 as prognostic and diagnostic biomarkers in Bangladeshi

patients, highlighting regional relevance of cytokine-based investigations in mental health (Sarmin et al., 2024).

1.15 Hypothesis

This study investigates the hypothesis that serum IL-5 levels differ between individuals with OCD and healthy control, and to correlate this level with clinical severity as measured by Y-BOCS. The following hypotheses are proposed:

Null Hypothesis (H_0): This hypothesis assumes there would be no significant difference exists in mean serum IL-5 levels between individuals with OCD and the healthy control.

Alternative Hypothesis (H_1): This hypothesis assumes there would be significant difference exists in mean serum IL-5 levels between the individuals with OCD and the healthy control, indicating IL-5's potential as a biomarker for OCD.

This study will measure IL-5 levels in both groups to generate experimental data that will either support or challenge the contribution of IL-5 in the pathogenesis of OCD. Furthermore, this study will examine the correlation between OCD disease severity, duration, or symptom severity, and observed alterations in IL-5 levels and examine prognostic and diagnostic biomarkers of IL-5. This study will compare IL-5 with other biomarkers such as IL-6, TNF-α, and IL-1β to differentiate its specific role that can impact psychiatric condition but may not be responsible for eosinophil immune activity(Sarmin et al., 2024). This study will also hypothesize a correlation between serum IL-5 levels and clinical characteristics such as age of onset, duration of illness, and specific symptom dimensions, which will provide more details of its role in the disorder. Based on the stated objectives, the study outcomes are outlined as follows:

Primary Outcome:

- Difference in mean serum IL-5 level between OCD patients and healthy control.

Secondary Outcome:

- Association between IL-5 levels between OCD patients and healthy control.
- Relationship between IL-5 levels and clinical variables such as age of onset, duration of illness, and symptom severity.

Table 3: Study Variable and measurement framework

Variable Type	Variable	Measurement	Purpose
Independent	OCD status	Diagnosis	Group Comparison
Dependent	IL-5	ELISA	Biomarker Analysis
Outcome	Severity	Y-BOCS	Association

Chapter 2

Methodology

2.1 Study Design

The purpose of this study was designed to examine the serum IL-5 levels between individuals diagnosed with OCD and healthy controls. This study's methodology includes proper participant selection, standardized assays procedure, and thorough statistical analysis. This research investigated the contribution of IL-5 in the neuroinflammatory process of OCD.

2.2 Study Duration & Setting

The research was carried out at the Govt. National Institute of Mental Health (NIMH) & Hospital, Dhaka, Bangladesh. The study was conducted over approximately 4 months. This timeframe was adequate for patient selection, data collection, and laboratory analysis. Furthermore, it was sufficient to ensure an adequate sample size and perform proper assays procedure. It also ensured strong statistical analysis for hypothesis testing and reliable findings regarding IL-5 as a possible biomarker for OCD individuals in Bangladesh. This specific study setting and duration were selected to allow for the recruitment of adequate number of participants and through analysis of biological data.

2.3 Study Population

The research participants included individuals with OCD diagnoses based on DSM-5 criteria as well as age, sex, and BMI matched healthy controls from surrounding areas of the Dhaka city. A professional psychiatrist confirmed all OCD diagnoses, and ensured all the healthy controls are free from psychiatric conditions.

2.3.1 Diagnosis Of OCD

A specialist psychiatrist confirmed the OCD diagnosis in patients using the structured clinical interview for DSM-5 (American Psychiatric Association, 2013)**.** Symptom severity was expressed using the YBOCS. Patients were allowed to include in the study only if their YBOCS score was ≥16 to ensure a minimum level of symptomology. This inclusion criterion ensured moderate to severe symptomology, which increase the probability of detecting biological association.

Individuals with a history of life time psychiatric disorder, or any other DSM-5 axis I disorder were excluded to avoid confounding comorbidities.

2.3.2 Selection Criteria

All participants in the study, were Bangladeshi descendants. The OCD individuals in our study were from the National Institute of Mental Health (NIMH) & Hospital, Dhaka, Bangladesh. Controls were recruited from surrounding community and were matched with the OCD patients based on their BMI, sex, and age. Diagnosis of OCD were confirmed by a professional psychiatrist using DSM-5 based questionnaire. Individuals meeting all inclusion criteria were enrolled in the study. People with comorbidity disorder, excessive obesity, abnormal BMI (BMI>35kg/m^2), immune disorder, and active infectious disease were excluded. Participants with the history of alcohol and different narcotic dependency were also excluded.

2.3.2.1 Inclusion Criteria

The following standards were used in the selection of participants:

For OCD Patients:

1. Patients who were examined by a professional psychiatrist.
2. Patients with confirmed DSM-5 diagnosis of OCD.
3. Patients with the age range from 18 -60 years.
4. Patients with Yale-Brown obsessive-compulsive scale score ≥16.
5. Patients who provided written informed consent.
6. Bothe male and female patients were included.
7. Patients who had no exposure to psychiatric medication or psychotherapy.
8. Patients who have never abused or been dependent on drugs.
9. Patients with history of no physical illness.
10. Both married and unmarried patients
11. Both hospital inpatient care department (IPD) and hospital outpatient care department (OPD) patients.

For healthy controls

1. People with no current or lifetime psychiatric illness confirmed by SCIS-5.
2. Age, Sex, and BMI matched with patients.
3. People who provided written informed consent.
4. People did not use psychotropic medications within the past two weeks prior to blood sampling
5. People with no history of chronic infectious disease or recent infection within the preceding 30 days.
6. Pregnancy or lactation status at the time of study participation
7. People with no other psychiatric or any other diseases.

2.3.2.2 Exclusion Criteria

1. Patients with comorbid psychiatric disorder.
2. People with chronic inflammatory or autoimmune disease.
3. People with current acute infection.
4. People who were using immunomodulatory drugs.
5. People with Substance abuse or dependence.
6. Pregnancy or lactation for females.
7. People who had refusal or inability to provide informed consent.
8. Individuals with a first degree relative who diagnosed with a mental illness diagnosis.
9. People with significant medical illness including epilepsy, renal disease, cardiovascular disease, uncontrolled endocrine disease, and uncontrolled hypertension.
10. People suffering from any serious physical illness.

2.4 Sample Size and Sampling Technique

Total Sample size: n=428 (220 OCD patients and 208 healthy controls). To achieve fair comparison, sample size was determined based on similar Bangladeshi studies. Furthermore, this sample size was large enough to give an 80% chance of detecting difference in cytokine level while keeping the risk of incorrect results low at only 5% ($\alpha = 0.05$).

OCD group: n=220

Healthy control group: n=208

Sampling Method: Convenience sampling from both the inpatient and outpatient psychiatric clinic.

2.5 Ethical Considerations

2.5.1 Ethical Approval

The research followed the principle demonstrated in Helsinki declaration. Additionally, Southeast University's institutional Ethical Committee/ Review Board approved the study protocol. Before taking part in the study, every individual was given a detail explanation regarding objectives of the study and gave written informed consent. Individuals retained the right to withdraw at any moment without consequence. In addition to this, throughout the study, participant anonymity and confidentiality were maintained. Any monetary compensation was not offered to the participants for eliminating potential coercion. The study protocol maintained strict ethical guideline to ensure that all data were de-identified and secured to protect participant privacy. The following ethical criteria maintained are:

1. Blood sample were taken after their permission without any influence.
2. Every participant gave their free and informed written consent.
3. Permission was granted by Institutional review board of appropriate authority (Ethical Review Committee) with maintaining all the procedure properly.
4. We informed the corresponding authority immediately to solve this without any collateral damage, if there were any problem aroused or any confusion rose.
5. Our study protocol did not interfere with the patient's ongoing treatment.
6. Participants' questions were answered immediately, and, they were instructed to contact with the investigator for any other inquiries.
7. Before taking sample or information from people, they were informed the following information properly:
    a) The study's objective
    b) The study's nature
    c) The methodology and length of the research.
    d) They were properly explained that they have all the right of refusing or accepting the participation in the study.
    e) The study was carried out solely for scientific purpose.
    f) No one gets any financial benefit from the study.

g) This study has no involvement of any body organ, tissue, or fluid.
h) Every participant received comprehensive information about the risks and benefits.

2.5.2 Consent Form

Each participant provided written informed permission after being fully informed about the purpose and goals of the study. Where the decision-making capacity of any OCD patient suspected to be impaired, the written consent was obtained from their primary caregiver. Consent forms are attached in Appendix-A.

2.6 Procedure of Data Collection

2.6.1 Demographic and Clinical Data

A standard questionnaire was used to collect demographic (age, gender, education, occupation) and clinical data (duration of illness, age of onset, family history, medication history). This collected data covered detail sociodemographic information and a comprehensive clinical assessment. This also included Y-BOCS score for OCD severity and a through medical history to identify comorbidity status.

2.6.2 Assessment of OCD Severity

A trained psychiatrist assessed the symptom severity of OCD by using clinician-administrated Y-BOCS scale which is a reliable 10-item scale (total score 0-40) with established validity in OCD research(Hossain et al., 2025). On a scale of 0-40, with higher scores correspond to severe symptoms.

2.7 Blood Sample Collection

2.7.1 Material Required

Table 4: Material Required for Blood Sample Collection

Material	Volume/Capacity/Usage
Sterile Syringes with 22-gauge needle	5 mL
Serum separator vacutainer tubes	3-10 mL

Eppendorf tubes (microcentrifuge tubes)	1.5-2.0 mL
Falcon tubes (centrifuge tube)	15 mL or 50 mL
Tourniquet	q.s.
Sterile cotton	q.s.
Antiseptic solution (e.g. 70% alcohol swab)	1-2 mL per swab
Adhesive bandages	q.s.
Disposable Gloves	q.s.
Dry ice or refrigeration unit	5 L

Representative materials used in the present study are shown in Figure 9 to Figure 14.

Figure 9: Cold box used for temporary transportation of blood samples.

Figure 10**:** Multichannel micropipette used for dispensing reagents and samples during ELISA.

Figure 11: Labeled Eppendorf Tubes containing serum

Figure 12: Electronic centrifuge used for separation of serum from blood samples.

Figure 13: Centrifuge tube

Figure 14**:** Ultra-low temperature freezer used for storage of serum samples.

2.7.2 Collection from OCD Patients

We collected five milliliters of venous blood from the antecubital vein under aseptic conditions after overnight fast. Patients were selected randomly after the examination by a professional psychiatrist. Then inclusion and exclusion criteria were applied. Before collecting sample, we obtained some specific information with their consent, such as their medical history, a clinical that focused on height, weight, age, sex, and the severity symptom, the duration of illness, and the medication they were taking, duration of treatment, age of commencing treatment, and family history of OCD. The collected blood was sent to the laboratory for further processing. In the laboratory cold chain protocols was maintained to preserve sample integrity.

after overnight fast. Patients were selected randomly after the examination by a professional psychiatrist. Then we used the criteria for inclusion and exclusion. Prior to sample collection, we obtained some specific information with their consent, including medical history, a clinical examination with a focus on age, sex, height, weight, and severity of symptoms, the length of illness, the medication used with their doses, the length of treatment, the age at which treatment began, and any family history of OCD. The collected blood was sent to the laboratory for further processing. In the laboratory cold chain protocols was maintained to preserve sample integrity.

2.7.3 Collection from healthy control

The blood samples were collected from healthy controls using same procedure.

2.8 Serum Separation and Storage

Blood samples were permitted to clot for 30 minutes at room temperature. Following clotting, the samples were centrifuged at 3,000 rpm (approximately 1,000 × g) for 10 minutes at 4ºC to separate the serum. The separated serum was then aliquoted into cryovials and stored at -80ºC until biochemical analysis to minimize the degradation of target analytes. This careful handling procedure ensured biomarker stability. This Biomarker stability is crucial for accurate measurement in subsequent analytical procedures. The equipment used for serum processing and storage is shown in Figures 12,13, and 14.

2.9 Laboratory Analysis of IL-5

2.9.1 Material Required for the Analysis of Serum IL-5

Table 5: Material Required for the Analysis of Serum IL-5

Material	Volume/Capacity/Usage
Mouse anti-human IL-5 monoclonal capture antibody	100 µL per well
Biotinylated goat anti-human IL-5 polyclonal detection antibody	100 µL per well
Avidin-biotin-peroxidase complex (ABC)	100 µL per well
Lyophilized recombinant human IL-5 standard	100 µL per well

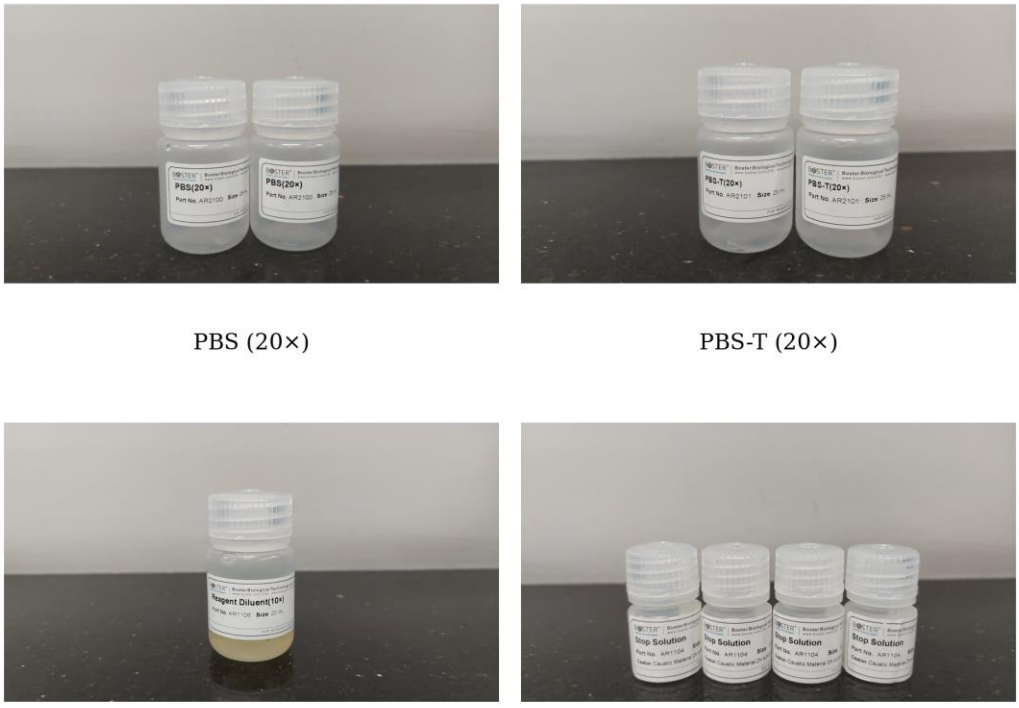
96-well removable strip microplates	100 µL per well
Plate sealers	q.s.
Reagent diluent	q.s.
PBS concentrate	Dilute to 1 × q.s.
PBS-T concentrate	Dilute to 1 × q.s.
Color developing reagent (TMB)	100 µL per well
Stop solution ($2NH_2SO_4$)	50-10 µL per well

The following kit materials and reagents were used for IL-5 Estimation

Figure 15: Boster EZ-Set Accessory Kit used with the Human IL-5 ELISA kit. & Boster Human IL-5 EZ-Set ELISA kit packet used for serum IL-5 estimation.

Figure 16: 96-well microplates used for ELISA assay.

Figure 17: Color developing reagent (TMB) / substrate solution used for signal development in ELISA.



PBS (20×) PBS-T (20×)

Reagent Diluent Stop Solution

Figure 18**:** ELISA accessory reagents including PBS (20×), PBS-T (20×), reagent diluent, and stop solution

2.9.3 Reagent Preparation for IL-5

Prior to use all the reagents were brought to room temperature. On the day of the assay, we prepared fresh reagents to ensure stability and optimal assay performance. Boster ELISA kit reagents were prepared and diluted according to the assay requirements. This process includes standard dilution, wash buffer, and other assay solutions. The prepared reagents were mixed and use immediately.

2.9.3.1 Wash Buffer Preparation

1×PBS was prepared by adding 25 mL of PBS concentrate to 475 mL of distilled or deionized water to make 500 mL. Similarly, 1×PBS-T was prepared by adding 25 mL of PBS-T concentrate to 475 mL of distilled or deionized water to make 500 mL.

2.9.3.2 Preparation of Biotinylated Anti-Human IL-5 Antibody

Each vial of biotinylated goat anti-human IL-5 polyclonal antibody contained 500 µL reagent. The working solution was prepared by diluting the antibody 1:100 with reagent diluent that is 1 µL antibody with 99 µL reagent diluent or equivalent proportion.

2.9.3.3 Preparation of Avidin-Biotin-Peroxidase Complex

The avidin-biotin-peroxidase complex working solution was prepared by diluting the ABC reagent 1:100 with reagent diluent immediately before use.

2.9.3.4 Preparation and Dilution of Human IL-5 Standard

Lyophilized recombinant human IL-5 standard should be reconstituted with 1.0 ml. of reagent diluted to a stock concentration of 10 ng/ml. This concentration then allowed to stand for at least 10 minutes with gentle agitation before preparing serial dilutions.

The following final standard concentrations were obtained by preparing serial dilutions:

- Tube 1: 500 pg/mL
- Tube 2: 250 pg/mL
- Tube 3: 125 pg/mL
- Tube 4: 62.5 pg/mL
- Tube 5: 31.25 pg/mL
- Tube 6: 15.625 pg/mL

- Tube 7: 7.8125 pg/mL
- Tube 8: 0 pg/mL (blank)

To prepare Tube 1, 50 µL of the 10 ng/mL stock solution was added to 950 µL reagent diluent. Tubes 2-7 each initially received 300 µL reagent diluent, and 300 µL was serially transferred from one tube to the next to obtain a final volume of 600 µL in each tube. Tube 8 served as the blank

2.9.3.5 Plate Preparation

The capture antibody was diluted 1:100 with capture antibody diluent (PBS), and 100 µL of diluted capture antibody was added to each well of a 96-well microplate. The plate was sealed and incubated overnight at 4ºC. Following incubation, the liquid was discarded, and the wells were blocked with 200 µL/well of reagent diluent for 2 hours at room temperature. The plate was washed with PBS before sample loading.

Plate

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
A	STD-1	STD-2	STD-3	STD-4	STD-5	STD-6	STD-7	Blank	P	P	P	P
B	P	P	P	P	P	P	P	P	P	P	P	P
C	P	P	P	P	P	P	P	P	P	P	P	P
D	P	P	P	P	P	P	P	P	P	P	P	P
E	P	P	P	P	**C**	C	C	C	C	C	C	C
F	C	C	C	C	C	C	C	C	C	C	C	C
G	C	C	C	C	C	C	C	C	C	C	C	C
H	C	C	C	C	C	C	C	C	C	C	C	C

Figure19: Plate Layout of IL-5 ELISA.

2.10 Assay Procedure

Boster Human IL-5 ELISA Kit was used during performing assay procedure. Reagents and materials were allowed to equilibrate to room temperature (18-25ºC) before the assay.

The assay was performed as follows:

1. All reagents, standard, and serum were prepared accordingly.
2. The required microplate stripes were placed in frame and unused strips were removed and stored appropriately.
3. A volume of 100 µL of standards, serum samples, or controls were pipetted into the designated wells. Standard and sample were assayed in duplicate whenever feasible.
4. The plate was sealed with a plate sealer and incubated for 120 minutes at room temperature or for 90 minutes at 37ºC.
5. Following incubation, the liquid was removed from the wells, and the plate was gently blotted on absorbent paper to eliminate residual buffer. Throughout the process care was taken to ensure the wells did not dry completely.
6. Then, 100 µL of prepared 1× biotinylated anti-human IL-5 antibody was added to each well.
7. The plate was incubated for an additional 90 minutes at room temperature (or 60 minutes at 37ºC).
8. Following incubation, the plate was washed three times with PBS, ensuring complete removal of residual liquid after each wash.
9. Then, 100 µL of prepared 1× avidin-biotin-peroxidase complex was added to each well.
10. The plate was incubated further for 40 minutes at room temperature (or 30 minutes at 37ºC).
11. The wells were then washed five times with PBS-T to remove unbound conjugate.
12. After washing, 90 µL of color developing reagent (TMB) was added to each well, and the plate was incubated in the dark for 30 minutes at room temperature or 25-30 minutes at 37ºC.Development of blue color was monitored.
13. The enzymatic reaction was halted by adding 100 µL stop solution to each well. The color changed immediately from blue to yellow.

14. Finally, Optical density (OD) was measured at 450 nm within 30 minutes using a microplate reader.

The assay range for IL-5 was 7.8-500 pg/mL, as stated in the kit overview.

Figure 20: Incubator used in sample incubation & ELISA Microplate reader

2.11 Standard Curve Preparation

A Standard curve was used to ensure accurate quantification of serum IL-5 levels. ELISA manufacturer guidelines were followed to prepare the standard curve. Using a Microplate reader the absorbance of the standard solution was measured at a wavelength of 450nm.

Standard solution of known concentrations was prepared using serial dilution. Then the standard concentration and their absorbance were recorded. A standard curve was then generated by plotting concentration on the x-axis and absorbance on the y-axis.

Table 6: Absorbance and concentration value of IL-5

Standard Concentration (pg/ml)	1000	500	250	125	63	31	16
Absorbance	0.28061	0.21850	0.12972	0.08561	0.04414	0.04849	0.01469

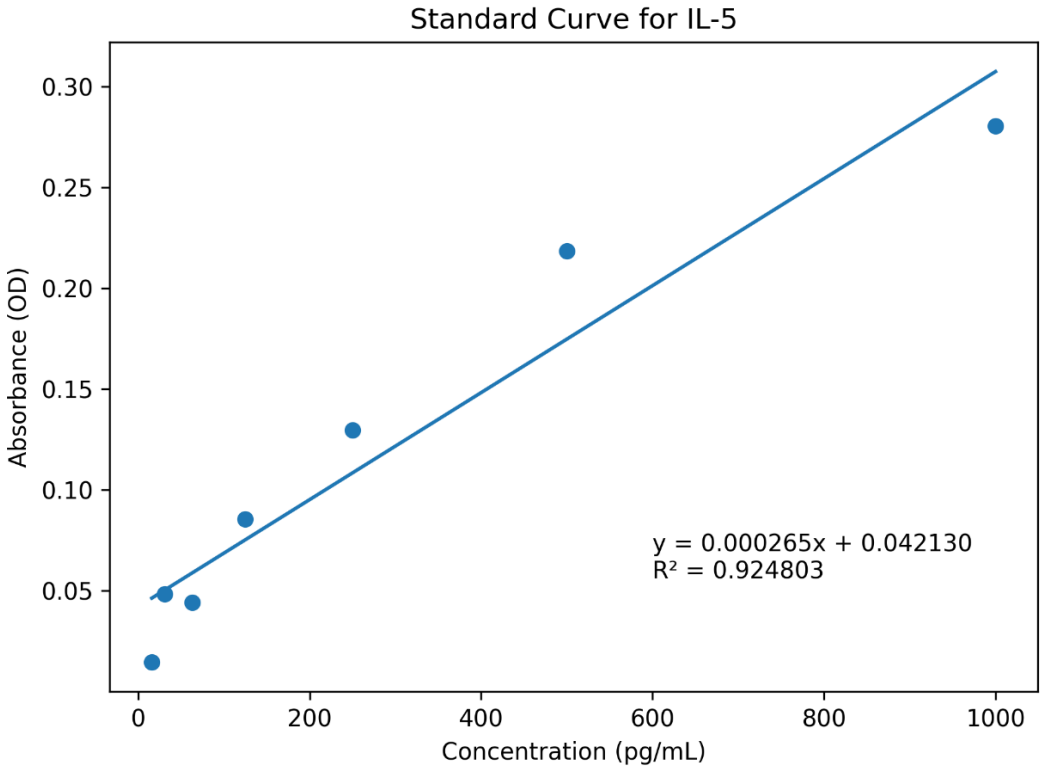


Figure 21: Standard Curve of Interleukin-5

We obtained an equation with linear R^2 value from the equation. From the equation we got concentration level of IL-5 by substituting the absorbance value obtained from the analyzer.

$$Y=0.000273x + 0.013948$$

$$R^2 = 0.946$$

From the above equation, the concentration was calculated by substituting the absorbance value.

$$\text{Concentration} = \frac{(Absorbance - 0.013948)}{0.000273}$$

2.11 Statistical Analysis

Following data collection, data were checked, and cleaned. Data entry was performed using SPSS software, and Microsoft Excel for analysis. Quantitative data were represented as mean ± standard deviation (SD) or median with interquartile range (IQR), depending on data distribution. Qualitative variables were expressed as frequency and percentage.

For comparison between OCD patients and healthy controls:

- For normally distributed continuous variables independent sample t-test was used.
- For categorical variables Chi-square test was used.

Correlation between serum IL-5 and severity of OCD was assessed using Pearson's correlation coefficient. A p-value of <0.05 was considered statistically significant.

The optical density (OD) values obtained in duplicate were averaged, the mean OD of zero standard was subtracted from each reading. A standard curve was then generated for calculating sample concentrations. Though linear regression may also be used with lower precision, the IL-5 kit insert recommends a four-parameter logistic (4-PL) curve fit is recommended for more accurate analysis. For diluted samples, the obtained concentration was multiplied by the dilution factor.

2.12 Outcome Measures

The primary outcome measures were:

- Serum IL-5 level in OCD patients and healthy controls.

The secondary outcome measures were:

- Association of serum IL-5 with severity of OCD.
- Relationship between inflammatory biomarker levels and selected demographic.

2.13 Data Management

To ensure participant confidentiality, each participant was assigned a unique identification code. All Data collection forms, laboratory results, and electronic datasets were stored securely. Only

authorized repetitive had the access to the data. Hard copies were stored in a locked cabinet. Before final analysis data were checked properly.

2.14 Quality Control

The following measures were taken during the study:

- Proper inclusion and exclusion criteria were applied to select participants.
- OCD diagnosis and severity assessment were performed by using standard psychiatric procedures.
- Aseptic conditions were maintained during blood samples collection.
- Serum was separated promptly and appropriately for avoiding degradation.
- Manufacturer instructions were followed for preparing ELISA reagents.
- All samples and standards were preferably run in duplicate.
- Calibration curves were prepared for each assay batch.
- Washing and incubation times were strictly maintained.
- Optical density was read within the recommended time.
- To reduce technical error, all laboratory procedures were performed carefully.

Chapter 3

Result & Discussion

3.1 Result

Findings from the analysis of serum IL-5 levels in patients with OCD and healthy controls are represented in this chapter. This research included 428 participants (220 OCD patients and 208 healthy individuals). This section describes the socio-demographic characteristics, biophysical parameters, and serum IL-5 levels between two groups. Proper statistical procedures were used to evaluate the differences between the two groups. Tables and graphs are used to present a clear and comprehensive interpretation of the findings.

3.1.1 Socio-demographic Characteristics of the Study Population

Table 7 summarizes socio-demographic characteristics of the study population. Total 428 participants were included (220 OCD patients and 208 healthy individuals). The distribution was analyzed by age range, marital status, gender, education, BMI class, occupation, residence, economic impression, and smoking history.

Age group

OCD people and healthy individuals exhibited similar age and the majority of them were young. The 18-25 years age group represented 57.27% of OCD patients and 53.37% of healthy controls. The next largest group was the 26-35 age group where 24.09% of OCD patients and 26.92% of controls. The 36-45 years age group represented 14.55% of OCD patients and 13.46% of healthy controls. A comparably smaller proportion was fell into the 46-60 years group. An independent samples t-test confirmed no significant difference between the groups (P=0.639).

Gender

The two groups had a similar number of males and females. 52.27% of OCD participants were male and 47.73% female. For healthy controls, 58.17% were male and 41.83% female. No significant difference existed between the groups (P=0.220).

Marital Status

Most of the participants were unmarried. In the OCD groups, the percentage was 58.64% and for healthy control, it was 54.33%. The married participants had 41.36% OCD patients and 45.67%

healthy controls. No statistically significant difference in marital status between the two groups (P=0.369).

BMI Class

Most of the participants showed a normal BMI level. The participants with a normal BMI level consisted of 67.73% OCD patients and 57.69% healthy controls. Overweight individuals represented 25% of OCD patients and 33.65% of healthy controls. However underweight individuals represented smaller proportion in both groups. No statistically significant difference in BMI class between the two groups (P=0.095).

Education

Majority of the OCD participants completed secondary education. This group comprised 55.91% secondary education completed and 37.73% graduation and above level completed. The primary and illiterate categories were represented in smaller proportion. Conversely, healthy individuals showed higher proportion in secondary education than graduation level. The secondary education completed healthy control were 45.19% and graduation and above level completed healthy controls were 37.02%. However, healthy control showed higher proportion of primary education compared to OCD patients. A statistically significant difference existed between the groups (P=0.002).

Occupation

Occupational status of participants exhibited a statistically significant difference between two groups (P<0.001). Among the OCD patients 34.09% were unemployed, 30% were students, 27.73% service holders, and 10% housewives, and a small proportion engaged in business and other occupations. Conversely, healthy controls were 38.46% unemployed, 37.02% service holders and, 24.04% housewives. There were no student and business professional in the healthy groups.

Economic Impression

In terms of economic status, a Statistically significant difference was identified between the two groups (P<0.001). Among both groups, the majority of the participants represented a medium economic status, which is 56.36% of OCD patients and 69.23% of healthy controls. However, OCD patients showed a 35.91% low-income group and a 7.73% high income group, which is comparably higher than the healthy controls.

Residence

A statistically significant difference was observed in residential status between two groups (P<0.001). The majority of the OCD patients resided in urban areas (82.73%). However, a significant proportion of healthy controls were from rural areas (38.94%).

Smoking History

Non-smokers were the majority in both groups. The smoker participants were higher in healthy controls (22.60%) than OCD patients (12.27%). Smoking history showed a significant statistical difference between the groups (P=0.005).

The data regarding sociodemographic characteristics demonstrated that age group, gender, marital status, and BMI class were comparable between OCD people and healthy Individual's. Conversely, education, occupation, residence, economic impression, and smoking history showed significant difference.

Table 7: Socio-demographic Characteristics of the Study Population

Characteristics	OCD Patients (n=220)	%	Healthy Controls (n=208)	%	p-value
Age Range					**0.639**
18-25	126	57.27	111	53.37	
26-35	53	24.09	56	26.92	
36-45	32	14.55	28	13.46	
46-60	9	4.09	13	6.25	
Gender					**0.220**
Female	105	47.73	87	41.83	
Male	115	52.27	121	58.17	
Marital Status					**0.369**
Married	91	41.36	95	45.67	

Unmarried	129	58.64	113	54.33	
BMI Class					**0.095**
CED (below 18.5)	16	7.27	18	8.65	
Normal (18.5-25.0)	149	67.73	120	57.69	
Overweight (above 25.0)	55	25.00	70	33.65	
Education					**0.002**
Graduate and above	83	37.73	77	37.02	
Illiterate	5	2.27	8	3.85	
Primary	9	4.09	29	13.94	
Secondary	123	55.91	94	45.19	
Occupation					**<0.001**
Business	6	2.73	0	0.00	
Housewife	22	10.00	50	24.04	
Other	1	0.45	1	0.48	
Service	50	22.73	77	37.02	
Student	66	30.00	0	0.00	
Unemployed	75	34.09	80	38.46	
Economic Impression					**<0.001**
High	17	7.73	0	0.00	
Low	79	35.91	64	30.77	
Medium	124	56.36	144	69.23	
Residence					**<0.001**
Rural	38	17.27	81	38.94	
Urban	182	82.73	127	61.06	

Smoking History					**0.005**
Non-smoker	193	87.73	161	77.40	
Smoker	27	12.27	47	22.60	

3.1.2 Clinical Profile of the Study Population

Table 8 presents the clinical profile of the study population using Y-BOCS scale. Y-BOCS is an instrument for measuring symptom severity of OCD individuals.

Among OCD individuals, the mean Y-BOCS score was 20.62±7.37, whereas healthy control had a Y-BOCS score of 3.45±1.77. This result shows a significant symptom severity between the two groups.

According to the statistical analysis, a highly significant difference (P<0.001) in Y-BOCS score between two groups affirms a clear clinical distinction between the groups. The significantly higher Y-BOCS score among OCD patients verify the presence of OCD symptoms, while lower score confirm that the healthy controls are symptom free.

Table 8: Clinical Profile of the Study Population

Clinical Parameter	**OCD Patients (n =220)**	**Mean ± SD**	**Healthy Controls (n =208)**	**Mean ± SD**	**p-value**
Y-BOCS Score	220	20.62 ± 7.37	208	3.45 ± 1.77	<0.001

3.1.3 Biophysical Characteristics of the study population

Table 9 presents the biophysical characteristics of the study population. Independent samples and statistical analysis were used to show the comparison between OCD individuals and controls.

The OCD patients mean body mass index (BMI) was 23.37±3.79 kg/m^2, whereas the healthy controls mean body mass index (BMI) was 23.41±3.88 kg/m^2. This result shows no significant

statistical difference in age between the two groups (P=0.447). This difference indicates groups were comparable in terms of age distribution.

Similarly, The OCD patients mean age was 27.90±8.17 years, whereas the healthy controls mean age was 28.50±9.28 years. This result shows a significant statistical difference in age between the groups (P=0.447). This result shows no significant statistical difference in age between the two groups (P=0.906). This difference indicates groups were comparable with respect to body composition.

The findings described that the groups were comparable regarding age and BMI. This similarity help reduces the chances of effecting the study outcomes.

Table 9: Biophysical Characteristics of the study population

Parameter	OCD Patients (n =220)	Mean ± SD	Healthy Controls (n = 208)	Mean ± SD	p-value
Age (years)	220	27.90 ± 8.17	208	28.50 ± 9.28	0.477
BMI (kg/m^2)	220	23.37 ± 3.79	208	23.41±3.88	0.906

3.1.4 Comparison of Serum Interlukin-5 Levels Between OCD and controls

Table 10 presents the comparison of serum IL-5 levels between OCD individuals and controls. To analyses and evaluate the differences between the two groups, an independent sample t-test was used

OCD patients mean IL-5 level was 2.43±1.19 pg/ml, whereas the healthy controls mean IL-5 level was 2.17±1.12 pg/ml. This indicates that OCD patient showed a slightly higher average IL-5 level compared to controls.

A significant difference was identified in serum IL-5 levels between the groups (P=0.020). A mean difference of 0.26 pg/ml between two groups indicates that there is measurable but modest elevation in IL-5 among OCD patients.

However, in relation to the variability reflected by the standard deviation within each group, the magnitude of this difference is relatively small. As the variables overlap, the individual IL-5 levels in OCD individuals and controls are not distinctly separated.

Therefore, these findings demonstrate that though serum IL-5 levels are statistically higher in OCD patients compared to controls, the degree of difference is limited.

Table 10: Comparison of Serum Interlukin-5 (IL-5) Levels Between OCD patients and healthy controls

Parameter	OCD Patients (n = 220)	Mean ± SD	Healthy Controls (n = 208)	Mean ± SD	p-value
Serum IL-5 (pg/ml)	220	2.43 ± 1.19	208	2.17 ± 1.12	0.020

3.1.5 Correlation Between Serum IL-5 Level and Y-BOCS Score

Table 11 Presents the relationship between serum IL-5 levels obsessive-Compulsive severity as measured by Y-BOCS scale.

Based on Pearson's correlation analysis, the calculated correlation is very weak negative (r =-0.076) between serum IL-5 levels and Y-BOCS scale scores. However, this association was not statistically significant (P=0.262). The results demonstrate that there was no significant association between serum IL-5 levels and the severity of obsessive-Compulsive symptoms severity in this study.

A slight difference in serum IL-5 levels between OCD patients and the healthy control group. However, no meaningful correlation between IL-5 levels and symptom severity within the OCD individuals was observed.

Table 11: Correlation Between Serum IL-5 Level and Y-BOCS Score Among OCD Patients

Variables	Correlation Coefficient (r)	p-value
Y-BOCS score vs Serum IL-5 level	-0.076	0.262

3.1.6 Distribution and Variability of IL-5

Descriptive statistics and graphical analysis were used for further examining the distribution and variability of Serum IL-5 levels between OCD patients and healthy controls. Results are presented using histograms, which are presented in the corresponding figures.

The standard deviation for Serum IL-5 levels was relatively high compared to the mean differences for both groups (±1.19 in OCD patients and ±1.12 in healthy controls). These findings indicate a considerable degree of variability in IL-5 levels between groups.

More insights regarding distribution of serum IL-5 levels between the groups were achieved through graphical presentation. The error bar plot shows the variability and overlaps between OCD individuals and controls. Overlap in interquartile ranges and closely aligned median values are shown by the box plot. Similarly, histogram analysis shows a comparable distribution pattern in both groups.

Though a significant difference in mean IL-5 levels, substantial overlap in distributions suggests relatively high variability within groups.

3.1.7 Graphical Presentation

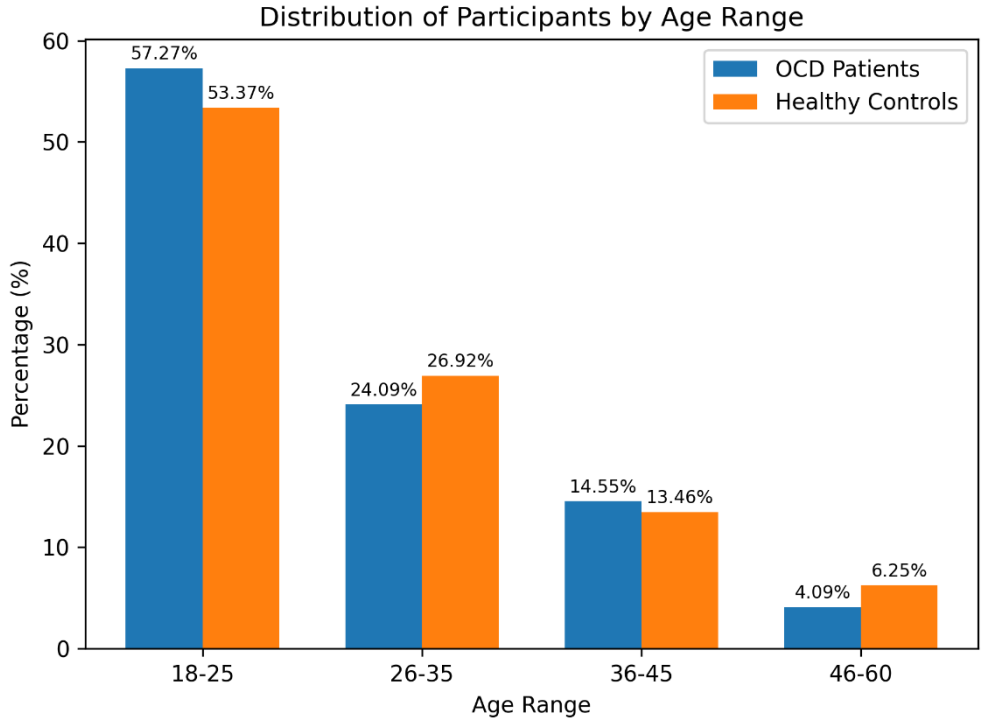


Figure 22: Comparison of age in years between OCD individuals and controls

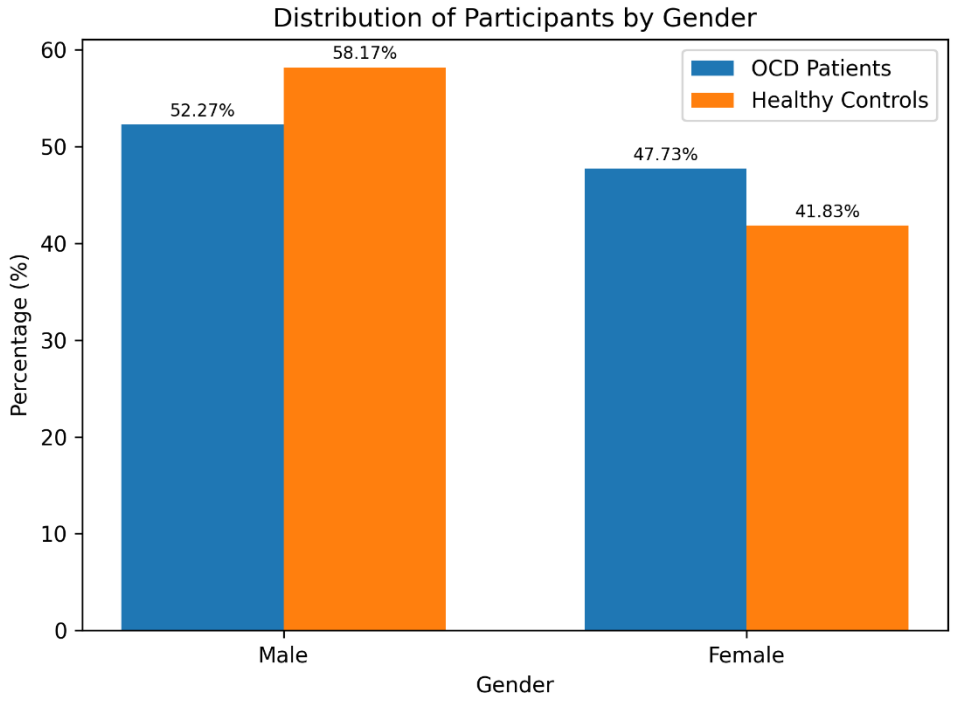


Figure 23: Comparison of gender between OCD individuals and control

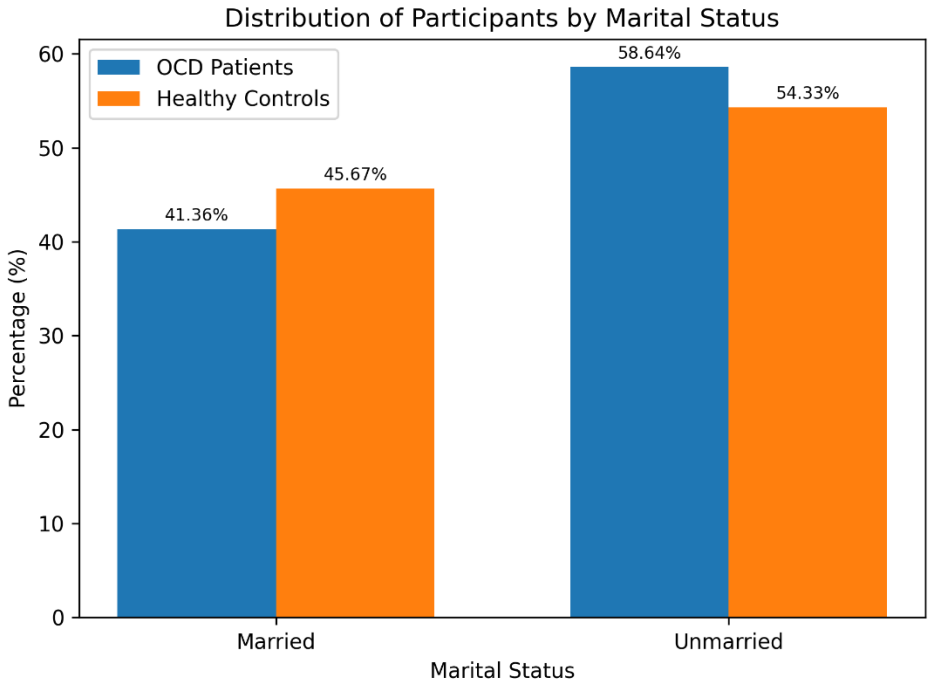


Figure 24: Comparison of Marital status between OCD individuals and controls

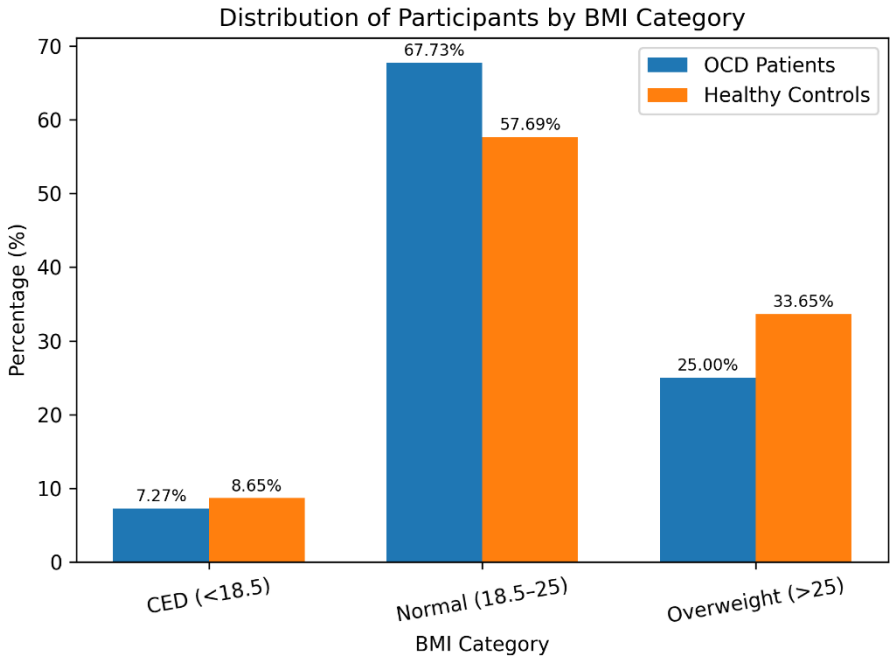


Figure 25: Comparison of BMI Class between OCD individuals and controls

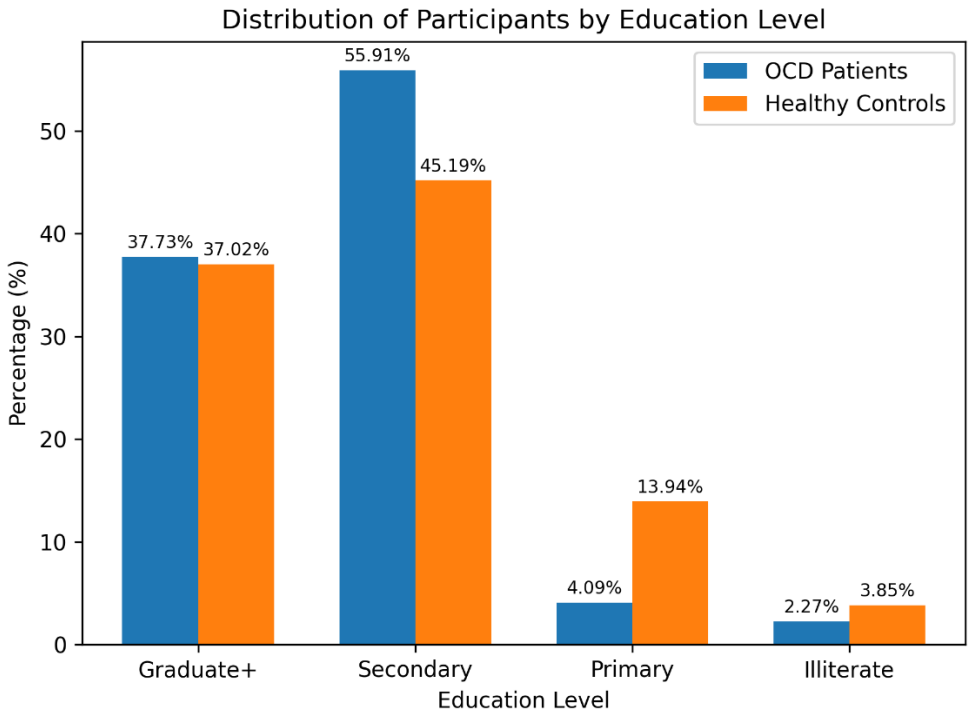


Figure 26: Comparison of Education level between OCD individuals and controls

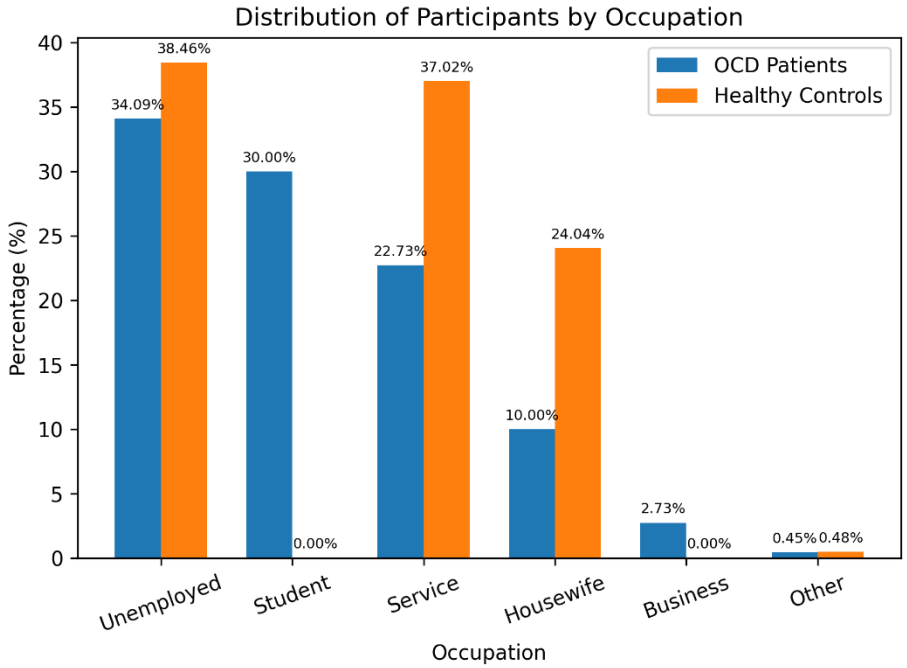


Figure 27: Comparison of occupation between OCD individuals and controls

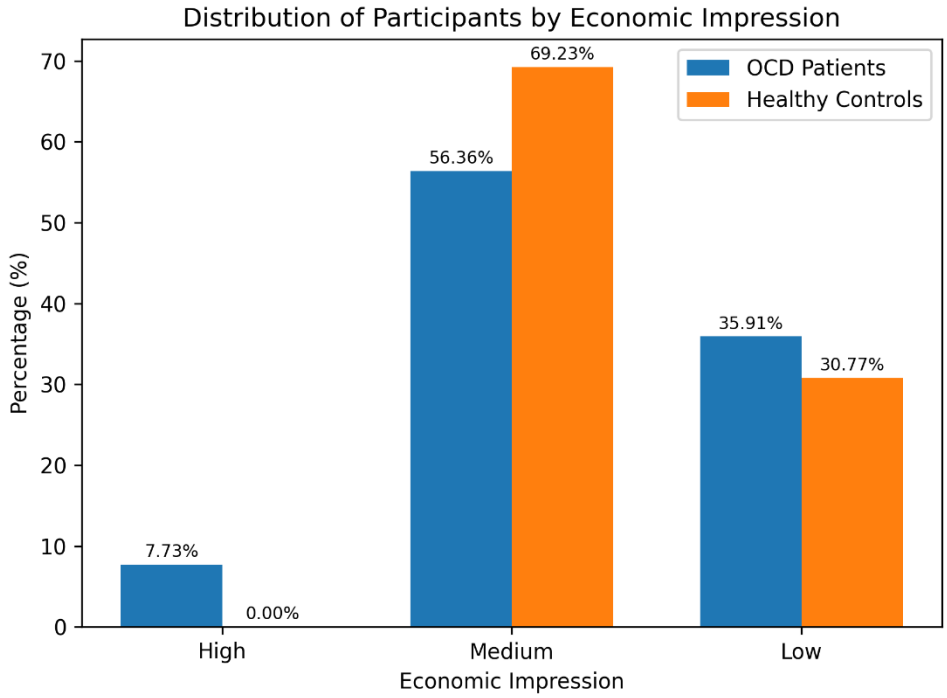


Figure 28: Comparison of economic impression between OCD individuals and controls

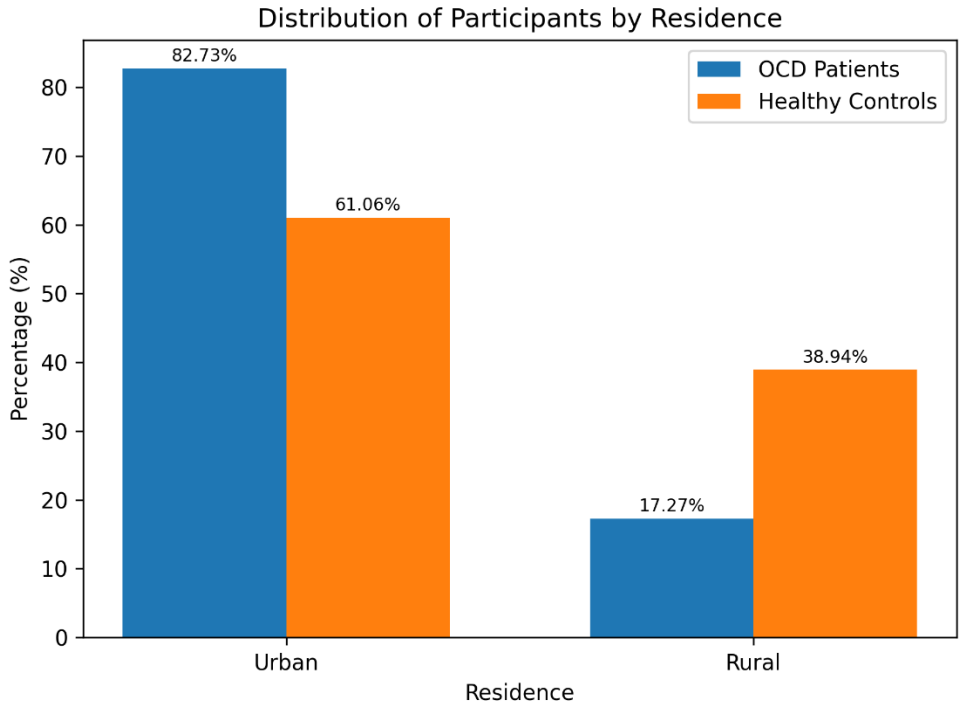


Figure 29: Comparison of area of residence between OCD individuals and controls

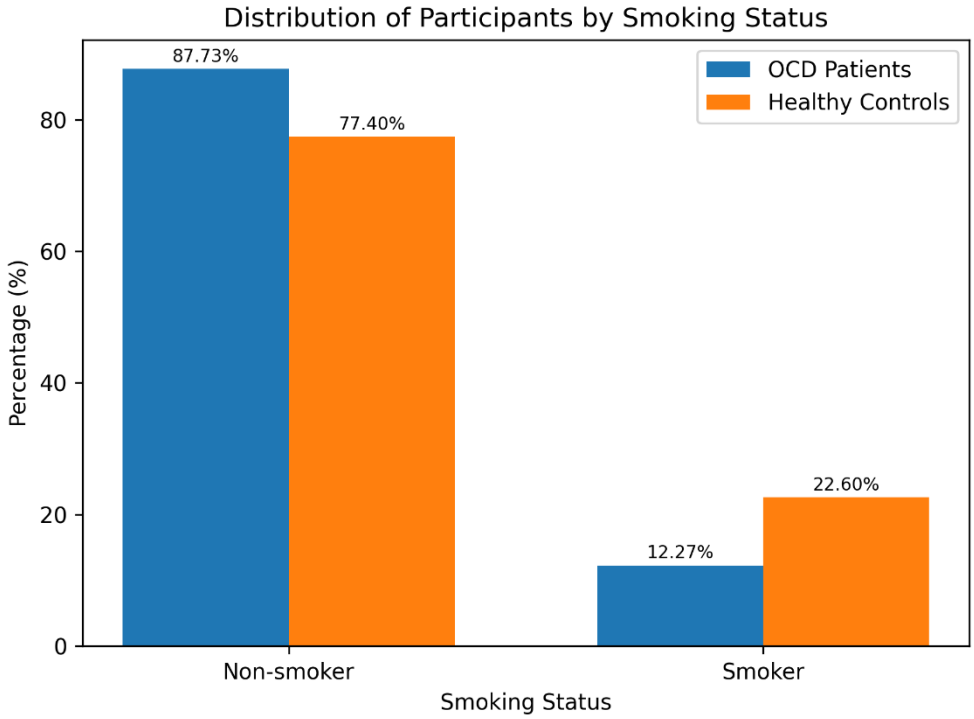


Figure 30: Comparison of smoking status between OCD individuals and controls

3.2 Discussion

This research aimed to assess serum IL-5 levels in OCD patients and evaluate their potential association with disease severity. The results suggest immune related mechanisms may contribute in OCD development (Constable & Hou, 2022).

The sociodemographic analysis showed that age group, gender, marital status, and BMI category were comparable between OCD people and healthy individuals (Kart & Yucens, 2020) (Teksin et al., 2023). This comparability suggests that these variables are unlikely to influence primary outcomes. However, education, occupation, economic status, residence, and smoking history showed a significant difference. This difference may indicate the socio-environmental variations between the groups (Zengin İspir et al., 2023). However, the scope of the present study cannot determine their direct influence on IL-5 levels.

The clinical profile of the study participates showed higher Y-BOCS scores compared to controls. This higher score confirms the presence of substantial symptom severity in patient group. As Y-

BOCS score was within the moderate range, the study population primarily consisted of moderate OCD patients. These findings provide a solid clinical basis for interpreting the biomarker findings.

Serum IL-5 analysis demonstrated a statistically significant increase in OCD individuals compared to controls. However, A relatively small difference was identified. Result suggests that IL-5 may be associated with the biological process of OCD. However, its contribution is limited. This increase in IL-5 levels presents a mild immune activation not a primary pathological mechanism (Martino et al., 2020b).

It is important to demonstrate that no statistically significant association was identified between serum IL-5 levels and Y-BOCS scores-based on correlation analysis. The correlation result shows a weak negative correlation, which indicates that IL-5 does not vary in a consistent manner with OCD symptom severity (Şimşek et al., 2016). Result indicates that IL-5 may not be a reliable marker of disease severity in OCD.

The analysis of distribution and variability further supports the analysis of this result. As the standard deviations are relatively high and there was a substantial overlap between OCD individuals and controls, the IL-5 levels were distributed across both groups. The graphical presentation confirmed the clear separation between the groups. This overlap reduces the discriminatory power of IL-5 as biomarker and further supports the absence of association with clinical severity (Şimşek et al., 2016).

Collectively, the results suggest that although serum IL-5 was slightly higher in OCD patients, the difference is small and showed no significant correlation with symptom severity (Fontenelle et al., 2012). As a result, IL- 5 may contribute a secondary or supportive function in the pathophysiology of OCD (Martino et al., 2020b). This lack of association indicates that multiple biological pathways may be involved in the complexity of the disorder (Constable & Hou, 2022).

The study's primary strength includes its large sample size and the participation of both clinical and control group, increasing the reliability of the results. In addition, use of standardized procedure and appropriate statistical analyses demonstrate the robustness of this research work.

However, the study exhibits certain limitations. Overall immune profile was not fully assessed, as this study focused on only one cytokine. Other factors, such as diet, stress, or subclinical infections, may influence cytokines (Martino et al., 2020b).

To sum up, the results suggest that there were slightly higher IL-5 levels in OCD patients. This difference is modest and not strongly associated with OCD symptom severity. Variability and overlap between two groups indicate that IL-5 alone may not be a reliable biomarker for OCD severity. Therefore, these results highlight that the implication of IL-5 is limited as a standalone biomarker and suggests further investigation incorporating multiple biomarkers to better understand the underlying mechanism of the disorder (Fontenelle et al., 2012).

Chapter 4

Conclusion

The present study examined serum IL-5 levels in Bangladesh OCD patients and determined their association with symptom severity. The results show that IL-5 levels were slightly but statistically significantly higher in OCD patients than in controls. However, no statistically significant association was identified between IL-5 level and Y-BOCS scores.

In conclusion, serum IL-5 is not substantially correlated with the severity of OCD symptoms among Bangladeshi OCD patients. Therefore, IL-5 may not be a predictive biomarker for OCD severity based on our findings.

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Appendix

1. Participant Consent Form:

Evaluation of Serum IL-5 among Bangladeshi OCD patients: A case-control study

Investigator's Name:

Institution: National Institute of Mental Health (NIMH) & Hospital, Dhaka, Bangladesh.

Record of Patient:

Patient No: Registration No: Date:

2. Volunteer Consent Form (English)

I, the undesigned, authorize the research student to consider me as a volunteer for his/her research work. I understand that I can change my mind at any time to withdraw myself as a volunteer during this research work.

Please tick as appropriate

Have your complete idea about the type, ultimate goal, and methodology of the research?

Y N

Are you aware that you don't have to face any physical, mental and social risk for this?

Y N

There will be no chance to injury in any of your organs, are you aware of this?

Y N

Have you got any idea about the outcome of this experiment? Y N

Have decided intentionally to participate in this experiment? Y N

Do you think this experiment violate your human rights? Y N

Are you sure that all the information regarding you will be kept confidentially?

Y	N

No remuneration will be provided for the experiment, are you aware of this?

Y	N

After reading the above-mentioned points, I am expressing my consent to participate in this experiment as a ***volunteer.***

Volunteer Signature with date: _____

[Please return the signed copy to the research student and keep an extra copy for yourself]

3. Volunteer Consent Form (Bangla)

সম্মতিপত্র

১.	এই গবেষণা কর্মের ধরণ, উদ্দেশ্য এবং পদ্ধতি সম্পর্কে কি পুরো জানতে পেরেছেন?	:	হ্যাঁ / না
২.	এই গবেষণায় নার্সদের মাধ্যমে রক্ত সংগ্রহ করা হবে, এ বিষয়ে কি অবহিত হয়েছেন?	:	হ্যাঁ / না
৩.	এই গবেষণার ফলাফল এবং সম্ভাব্য কল্যাণের বিষয়ে আপনার ধারনাটি স্পষ্ট হয়েছে কি?	:	হ্যাঁ / না
৪.	এই গবেষণা কর্মে অংশগ্রহণ, সহযোগিতাদান, অথবা বিরত থাকার সিদ্ধান্ত আপনি কি স্বাধীনভাবে গ্রহণ করতে পেরেছেন?	:	হ্যাঁ / না
৫.	গবেষণা কর্মে অংশগ্রহণের ফলে আপনার মৌলিক মানবাধিকার কি ক্ষুণ্ন হচ্ছে?	:	হ্যাঁ / না
৬.	আপনি কি পরিপূর্ণ ভাবে জ্ঞাত যে, আপনার তথ্যাবলির গোপনীয়তা বজায় রাখা যাবে?	:	হ্যাঁ / না
৭.	গবেষণা কর্মে অংশগ্রহণের জন্য আপনাকে কোন পারশ্রমিক অথবা ভ্রমণভাতা দেয়া হবে না, এ বিষয়ে কি যথেষ্ট অবহিত আছেন?	:	হ্যাঁ / না

অনুমতি পত্র

এই গবেষণা কর্মের উদ্দেশ্য, পদ্ধতি ও উপযোগিতা সম্পর্কে পূর্ণ ধারণা পেয়ে, এর নীতিগত বৈশিষ্ট্য সমূহের প্রতি আমার সম্মতি প্রকাশ করছি। গবেষণা কর্মে অংশগ্রহণের জন্য আমি কোন ব্যাক্তি বা গোষ্ঠী দ্বারা প্রভাবান্বিত হইনি অথবা আমার মৌলিক মানবাধিকার ক্ষুণ্ন হয়নি। অতএব, যথাযথ পর্যালোচনা সাপেক্ষে আমি স্ব-প্রণোদিত হয়ে এই অনুমতি পত্রে স্বাক্ষর করছি।

নাম: স্বাক্ষর

_____ _____

4.

Questionnaires Form

Study of BDNF, IL-1 Beta, and ApoE in Obsessive-Compulsive Disorder Patients among Bangladeshi Population

1. Identification

1.1 ID Code:

1.2 Name

1.3 Father's/Husband's Name:

1.4 Sex

Male		Female	

1.5 Marital Status

1.6 Date of Birth(dd/mm/yy)

1.7 Age(Yr)

1.8 Phone No

1.9 Permanent Address

1.10 Religion

1.11 Nationality

2. Personal History

2.1	Area of residence	Rural	Urban	S-Urban	Others

1	Where have you spent your Childhood(1-15y)?				
2	Where have you spent at least 3/4th more of your lifetime?				

2.2	**Education Level**		2.3	**Occupation**		
	Illiterate			Professional/Managerial/Business/		
	Can read only			Clerical		
	Can write a letter			Technical		
	SSC or equivalent			Skilled Worker		
	HSC or equivqlent			Unemployed/Pensioner		
	Graduate or Higher			Housewife		
	Others			Others		

2.4	**Impression about Social Class**		2.4	**Family Expenses/Month**
	Rich			
	Upper Middle			
	Lower Middle			
	Poor			
	Destitute			

2.6	Smoking Habit		2.7a	Current Smoker	
	Never			Sticks/Day	
	Ex-smoker>6months		2.7b	Ex-smoker	
	Current smoker			Sticks/Day	

3. Previous History of Psychiatric Disorder Y N

4. Family History of Psychiatric Disorder: Y N

5. Case: New Old

6. Biological Characteristics:

6.1 Height(cm):

6.2 Weight(kg):

6.3 Pulse/min:

6.4 Temperature:

6.5 BP(sys/dias):

5.

YALE-BROWN OBSESSIVE COMPULSIVE SCALE (Y-BOCS)

Questions 1 to 5 for obsessive thoughts

1. How much of your time is occupied by obsessive thoughts?
   0 = None
   1 = Less than 1 hr/day
   2 = 1 to 3 hrs/day
   3 = Greater than 3 and up to 8 hrs/day
   4 = Greater than 8 hrs/day
2. How much do your obsessive thoughts interfere with your work, school, social or other important role functioning?
   0 = None
   1 = Slight interference, but overall performance not impaired
   2 = Definite interference, but still manageable
   3 = Substantial interference
   4 = Incapacitating
3. How much distress do your obsessive thoughts cause you?
   0 = None
   1 = Not too disturbing
   2 = Disturbing, but still manageable
   3 = Very disturbing
   4 = Near constant and disabling distress
4. How much of an effort do you make to resist the obsessive thoughts?
   0 = Try to resist all the time
   1 = Try to resist most of the time
   2 = Make some effort to resist
   3 = Yield to all obsessions without attempting to control them
   4 = Completely and willingly yield to all obsessions
5. How much control do you have over your obsessive thoughts?
   0 = Try to resist all the time
   1 = Try to resist most of the time
   2 = Make some effort to resist
   3 = Yield to all obsessions without attempting to control them
   4 = Completely and willingly yield to all obsessions

Questions 6 to 10 for compulsive behaviors

6. How much time do you spend performing compulsive behaviors?
   0 = None
   1 = Less than 1 hr/day
   2 = 1 to 3 hrs/day
   3 = Greater than 3 and up to 8 hrs/day
   4 = Greater than 8 hrs/day
7. How much do your compulsive behaviors interfere with your work, school, social or other important role functioning?
   0 = None
   1 = Slight interference, but overall performance not impaired
   2 = Definite interference, but still manageable
   3 = Substantial interference
   4 = Incapacitating
8. How would you feel if prevented from performing your compulsion?
   0 = None
   1 = Only slightly anxious if compulsions prevented
   2 = Anxiety would mount, but remain manageable if compulsions were prevented
   3 = Prominent and very disturbing
   4 = Incapacitating anxiety
9. How much of an effort do you make to resist the compulsions?
   0 = Try to resist all the time
   1 = Try to resist most of the time
   2 = Make some effort to resist
   3 = Yield to all obsessions without attempting to control them
   4 = Completely and willingly yield to all obsessions
10. How strong is the drive to perform the compulsive behavior?
   0 = Complete control
   1 = pressure to perform the behavior
   2 = Make some effort to resist
   3 = Very strong drive to perform behavior
   4 = Drive to perform behavior experienced as completely involuntary

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