"PREVALENCE OF GLUTAMINE DEFICIENCY IN CRITICALLY ILL CHILDREN: A CROSS-SECTIONAL STUDY IN 1 MONTH TO 18 YEARS OF AGE IN TERTIARY CARE HOSPITALS."

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With reference to the above, we wish to inform you that your proposed research project titled **"PREVELENCE OF GLUTAMINE DEFICIENCY IN CRITICALLY ILL CHILDREN-CROSS SECTIONAL STUDY IN 1 MONTH TO 18 YEARS OF AGE IN TERTIARY CARE HOSPITAL",** is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee.

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LIST OF ABBREVIATIONS

AA	–	Amino acids
AMA	–	Against medical advice
ARG	–	Arginine
ATP	–	Adenosine tri phosphate
BCAA	–	Branched chain amino acids
ELISA	–	Enzyme linked immunosorbent assay
GABA	–	Gamma- aminobutyric acid
GALT	–	Gut associated lymphoid tissue
GLN	–	Glutamine
GLS	–	Glutaminase
GS	–	Glutamine synthetase
LBW	–	Low birth weight
MODS	–	Multiple organ dysfunction syndrome
NADPH	–	Nicotin-amide adenine dinucleotide phosphate hydrogen
NMR	–	Nuclear magnetic resonance
PELOD	–	Paediatric logistic organ dysfunction
PICU	–	Paediatric intensive care unit
PRISM III	–	Paediatric risk Mortality III
ROS	–	Reactive oxygen species
SOFA	–	Sequential organ failure assessment
TCA	–	Tricarboxylic acid
VLBW	–	Very low birth weight
WFA	–	Weight for age

ABSTRACT

BACKGROUND:

Glutamine plays a vital role in immune function, gut integrity, and nitrogen transport. Critically ill children are at risk of glutamine deficiency due to increased metabolic demand and inadequate nutritional intake. This study aims to assess the prevalence of glutamine deficiency in critically ill pediatric patients admitted to tertiary care hospitals.

MATERIALS AND METHODS:

In this cross-sectional observational study, 172 children aged 1 month to 18 years admitted to the pediatric emergency department of Dr. Prabhakar Kore Hospital, Belagavi, were enrolled after obtaining ethical approval. Eligibility was determined based on WHO-defined critical illness criteria, and patients with inborn errors of metabolism were excluded. Age-appropriate assent was obtained, clinical data were recorded, and blood samples were collected, processed, and analyzed for glutamine levels using the ELISA-based E4078Hu Glutamine Assay Kit, with the results correlated to PRISM III scores. Statistical analyses were performed using SPSS version 22, employing Pearson correlation and t-tests, with a significance threshold of $p < 0.05$.

RESULTS:

The present study, conducted on 172 pediatric patients with a mean age of 7.7 years, revealed that 77.91% had glutamine deficiency, with a mean glutamine level of 0.41 ± 0.2 mmol/L ($p < 0.001$). The mean PRISM III score was 4.55, and the average PICU stay was 4.63 days. While 90.12% of patients were discharged, 5.81% left against

medical advice, and 2.91% did not survive. A significant negative correlation was observed between PRISM III scores and glutamine levels, indicating an association between lower glutamine levels and increased illness severity. Respiratory disorders had the highest prevalence, with a mean glutamine level of 0.45 ± 0.19 mmol/L, followed by central nervous system and infectious diseases. Notably, cases involving the hepatobiliary system and burns exhibited the lowest glutamine levels (0.26 ± 0.08 and 0.34 ± 0.08, respectively). Lower glutamine levels were also associated with prolonged PICU stays ($p = 0.012$).

CONCLUSION:

Glutamine deficiency is common in critically ill children and is associated with adverse clinical outcomes. Therefore, early identification and potential supplementation of glutamine in critically ill pediatric patients may improve prognosis. We recommended further studies are urgently needed to evaluate the impact of glutamine supplementation on clinical outcomes in this vulnerable population.

KEYWORDS:

Glutamine deficiency, PRISM III score, critically ill children, pediatric intensive care, disease severity, biomarker, immune nutrient, PICU stay, pediatric emergency, glutamine supplementation.

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INTRODUCTION

"Amino acids (AAs) are essential for life, serving as the primary structural units of proteins and playing a vital role in biological functions within mammals. They are the second most prevalent compounds in mammals after water. Sourced both from internal synthesis and dietary intake, amino acids are integral for cellular development, tissue repair, and overall growth. Additionally, mammals have adapted their metabolism to enhance amino acid breakdown during infections, a strategy that strengthens immune responses while restricting nitrogen-based nutrients available to pathogens." [1] Thereby, with the help of this evolutionary mechanism, the host gains an advantage in managing its inflammatory responses to infectious agents.[1]

"Among the spectrum of the 20 AA encoded by the genetic code, "**Glutamine**" emerges as a key player in the adaptability of AA "metabolism and immune function". Glutamine (Gln) is a five-carbon AA with two amino moieties and accounts for 30-35% of all amino acid nitrogen that is transported in the plasma membrane."[2] The chemical structure for glutamine is C5H10N2O3 and the mol. weight is 146.1445 Daltons (Da).[3] "Glutamine does play a crucial role in maintaining metabolic homeostasis; it also helps to support immune function and promote gut integrity, especially under conditions of stress such as critical illness. Glutamine acts as a fundamental precursor in the production of nucleotides, such as purines, pyrimidines, and amino sugars; nicotinamide adenine dinucleotide phosphate (NADPH); the nitric oxide precursor arginine (Arg); and the major antioxidant glutathione".[4,5]

"Gln is also an important oxidative fuel for rapidly proliferating cells such as the gastrointestinal tract,[6] the immune system, [7] reticulocytes, [8] fibroblasts and so on.[9] Also, it plays a central role in the exchange of nitrogen between tissues, especially from muscle to gut, kidney, and liver cells."[10] Furthermore, some studies also reported that Gln plays a part as a glucose biosynthesis precursor in the hepatic, renal, and gut. As well as it helps to regulate acid-base homeostasis.[11,12,13]

Traditionally, "Gln has been introduced as a nonessential AA, as it is synthesised by most tissues, with skeletal muscle serving as the primary site for its production and storage."[14] The last step in the formation of Gln is catalysed by glutamine synthetase, a major enzyme required for its breakdown.[15,16] "In mammals, the expression of glutamine synthetase is regulated through both transcriptional and post-transcriptional mechanisms." Specifically, stressors such as glucocorticoids can enhance glutamine synthetase mRNA expression, while Gln synthetase protein turnover is modulated by the concentration of its product, Gln.[17] "The critical role of glutamine (Gln) at the systemic level is evident from reports describing two unrelated newborns with congenital glutamine synthetase deficiency, who exhibited severe brain malformations, multi-organ failure, and neonatal mortality.. In these cases, Gln was notably absent from plasma, urine, and cerebrospinal fluid."[18]

Under normal physiological conditions, glutamine is released into the bloodstream to fulfil the metabolic requirements of various tissues. However, during periods of catabolic stress, its endogenous production may become insufficient to meet the heightened demands of the gastrointestinal tract, immune cells, inflammatory response, liver, and kidneys. As a compensatory mechanism, skeletal muscle undergoes proteolysis, breaking down protein stores to release glutamine into

circulation. This process helps sustain plasma glutamine levels but often leads to a depletion of its overall reserves.

Lacey and Wilmore[10] suggested that glutamine (Gln) may become a selectively essential AA for severely ill patients due to extensive evidence. In contrast, Ekmark et al. [19] found that glutamine reduction occurred in forty per cent of patients upon admission to the paediatric ICU, which was linked to multiple system failures. Their research emphasised that children exhibit unique physiological responses to stress due to their specific metabolic needs, stages of development, and developing immune systems. This underscores the necessity of studying glutamine dynamics specifically in paediatric critical care. However, the existing literature mainly focuses on adults, leaving a gap in studies that examine paediatric populations. As a result, there is insufficient data on the prevalence, clinical effects, and treatment implications of glutamine (Gln) deficiency in ill children.

Recent studies indicate that glutamine deficiency is correlated with negative outcomes, including extended hospital stays, heightened vulnerability to infections, and increased mortality rates among critically ill adults.[19,20,21] Moreover, glutamine supplementation has demonstrated potential benefits, such as enhanced immune function, improved gut integrity, and reduced inflammatory responses in certain adult populations.[22,23] These findings highlighted the probable importance of glutamine status in influencing clinical outcomes. Yet, translating these understandings to paediatric care is challenging, as children show significant variability in their nutritional requirements and metabolic responses to supplementation.

On the other hand, some previous investigations studied the "efficacy of supplemental Gln in premature infants of low birth weight (LBW), who are highly stressed and have low energy and protein reserves in paediatrics."[24] Like premature newborn, glutamine (Gln) addition offer potential benefits for various pediatric ailment, such as "gastrointestinal disorders, malnutrition, cancer, severe burns or trauma, and other chronic childhood diseases."

Intensive care units (PICUs) manage severely ill children with conditions such as sepsis, trauma, burns, and post-surgical complications, which increase metabolic demands and the risk of glutamine deficiency. Despite its importance, routine glutamine level monitoring is not standard in most PICUs due to limited awareness and the lack of standardised diagnostic criteria. Understanding the prevalence and clinical impact of glutamine deficiency is essential for developing targeted nutritional strategies. This study aims to enquire about the presence of glutamine deficiency among severely ill children aged 30 days to eighteen years admitted to a tertiary hospital.

AIMS AND OBJECTIVES

- **"Primary objective"-** To assess the "Prevalence" of glutamine deficiency in severely to critically ill children.

- **"Secondary objective"-** Correlate the glutamine levels with the PRISM III score.

REVIEW OF LITERATURE

History:

- **In 1873:** "Glutamine was first recognized as a biologically important molecule when indirect evidence suggested its role as a structural component of proteins".

- **During, 1883:** Few plant species had free glutamine.

- **Sir Hans Adolf Krebs (1900–1981)**[2] identified that mammalian tissues possess the capability to both breakdown and produce glutamine, marking a pivotal advancement in the study of glutamine metabolism.

- In the mid **19th century: Eagle et al.**,[25] reported that "isolated fibroblasts utilized glutamine in larger quantities than any other amino acid in cell incubation media. However, research was hindered as glutamine was classified as a non-essential amino acid, and measuring its levels in plasma and tissues was challenging."

- **1961 to 1980:** Researchers including **Hans Krebs [2] and co-workers**[7] examined metabolic control using diverse research approaches, encompassing laboratory-based cell studies, clinical investigations, and live organism experiments..[26]

- **Early/mid-1980s: Eric Newsholme**[7] provided evidence that glutamine plays a crucial role in modulating leukocyte function, particularly in lymphocytes[7] and macrophages.[27]

- **1986–1987: Newsholme P et al.**, for the first time, researchers documented that macrophages actively consume and metabolize glutamine. [2,27,28]

- **1997: Pithon-Curi et al.**, described "the first evidence of glutamine consumption by neutrophils."[29,30]

- From the late **19th century to the 20th century,** significant advancements in medical research and scientific innovations have continuously shaped our understanding of various diseases and their underlying mechanisms.

  The relentless progress in biomedical research has led to the identification and characterization of numerous rare genetic disorders, contributing to improved diagnostic and therapeutic approaches. One such ultra-rare disorder is congenital glutamine synthetase deficiency, a metabolic condition that, profoundly impacts the central nervous system. This disorder was first documented in **2005** when **Häberle J. and colleagues** reported three cases, highlighting its clinical presentation, genetic basis, and potential implications for patient management.[31,32,33]

Introduction to Glutamine and Its Role in the Human Body:

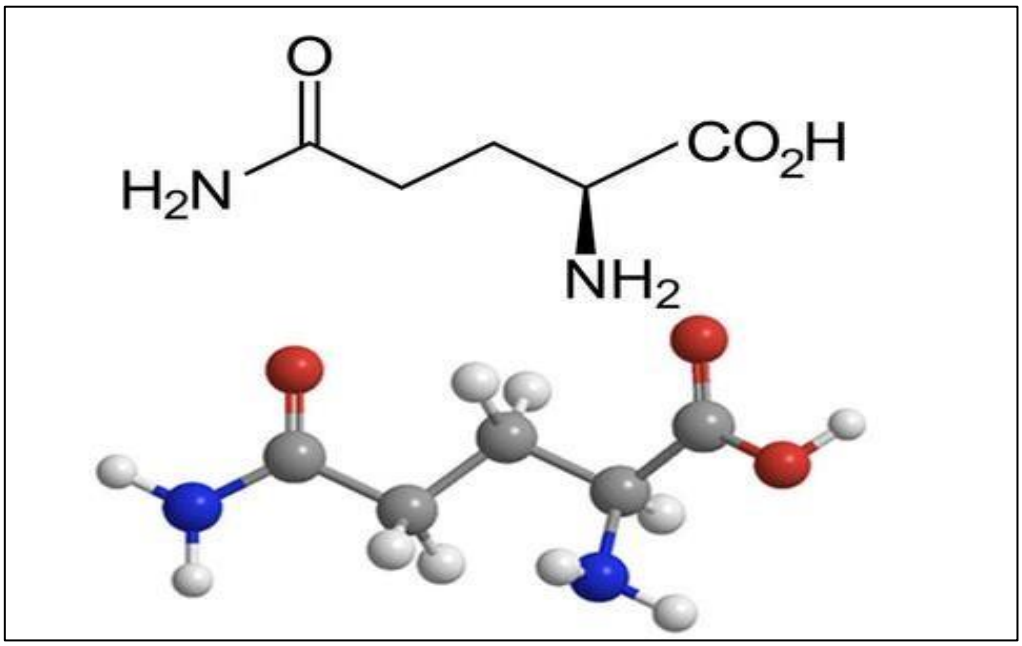
"Amino acid are vital components of proteins in cells and tissues, ranking as the second most abundant substance in mammals after water. They are derived from both endogenous and exogenous (dietary) proteins and are crucial for cell survival, maintenance, and proliferation. Mammals have evolved metabolic pathways to increase amino acid catabolism during infections, aiding immune responses by limiting nitrogen-containing nutrients for pathogens."[1] This also helps control the host's inflammatory responses to infection.

"Glutamine, the most abundant and versatile amino acid, plays a key role in intermediary metabolism, nitrogen exchange, and pH homeostasis. It is vital for nucleotide synthesis, NADPH production, antioxidants, and maintaining cellular function.[28,34,35] Immune components, such as "lymphocytes, neutrophils, and macrophages", rely on "glutamine" as a primary energy source under nutrient-restricted condition, like sepsis, burns, surgery recovery, malnutrition, and intense physical exercise." This concept, introduced by **Eric Newsholme**[7] in the 1980s, has since been confirmed by numerous studies.[34,35] As such, glutamine is termed the "fuel for the immune system," with low levels impairing immune function and increasing mortality risk.[21]

Molecular structure of glutamine:

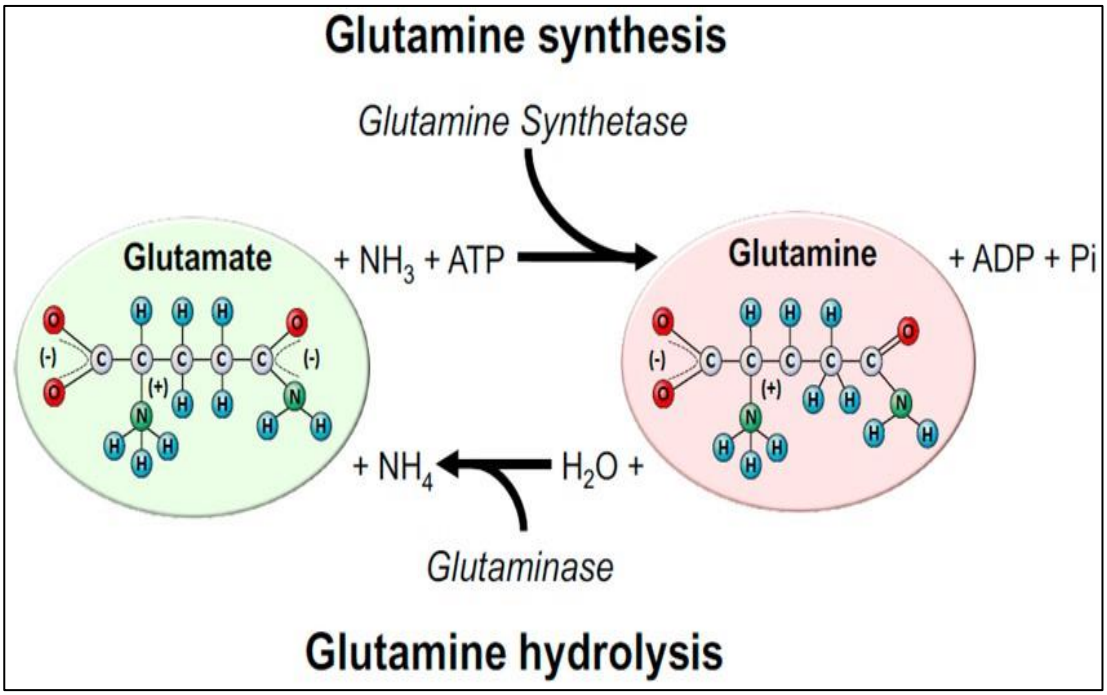
The amino acid glutamine is composed of butyric acid with an amino, carbamoyl, and carbamoyl substituents at positions 2, 4 respectively, as represented in Figure 1. It functions as a fundamental metabolite and is grouped as alpha-amino and polar amino acids. Additionally, it contains a "3-amino-3-oxopropyl group".

Figure 1: Structural Formulae.[3]



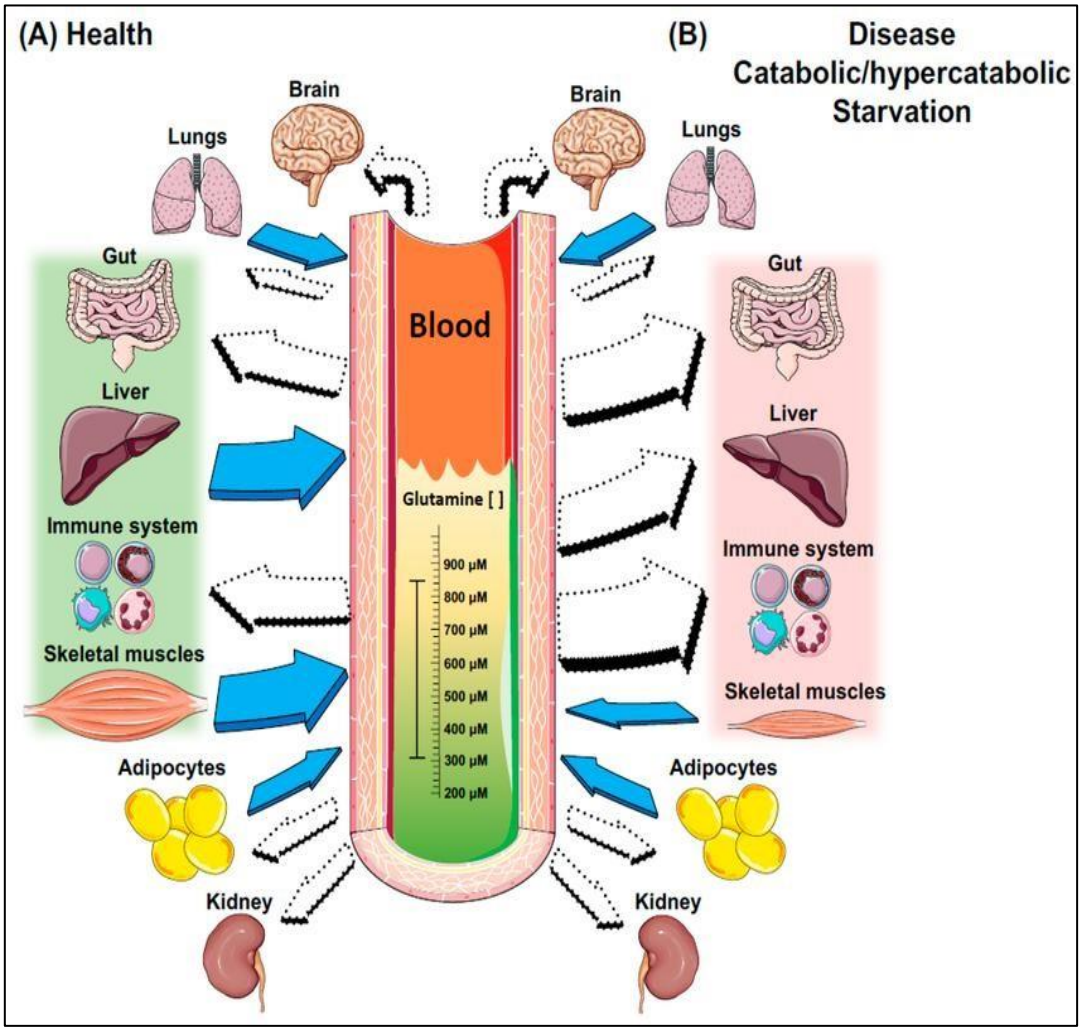
Biosynthesis of Glutamine: "Glutamine, an L-α-amino acid with a mol. weight of 146.150 kDa, is made primarily in the body through the action of the "enzyme glutamine synthetase (GS). GS catalyses the synthesis of glutamine from glutamate and ammonia (NH4+), using ATP as a source of energy" (Figure 2). This process occurs mainly in the cytosol of cells, where glutamate, derived from 2-oxoglutarate (NH4+), is synthesised either directly or from the breakdown of another amino acid like branched-chain amino acids (BCAAs), particularly leucine". The availability of glutamate is crucial for this process. Additionally, certain tissues, including the liver and skeletal muscles, are responsible for producing glutamine under normal conditions, contributing significantly to its synthesis and availability in the body. Glutamine synthetase activity is influenced by several factors, such as the availability of amino acids and hormonal regulation (e.g., glucocorticoids, thyroid hormones, and growth hormone).[36,37,38]

Figure 2: Glutamine synthesis.[36,37,38]



Glutamine breakdown: "Glutamine metabolism is tightly regulated by the enzyme glutaminase (GLS), which is responsible for the hydrolysis of glutamine into glutamate and ammonia (NH4+). This reaction predominantly occurs within mitochondria, providing glutamate, an essential precursor for the tricarboxylic acid cycle (TCA cycle), and contributing to energy production."

Figure 3: "Intratissue glutamine production and utilisation in health and catabolic/hypercatabolic situations."[37-41]

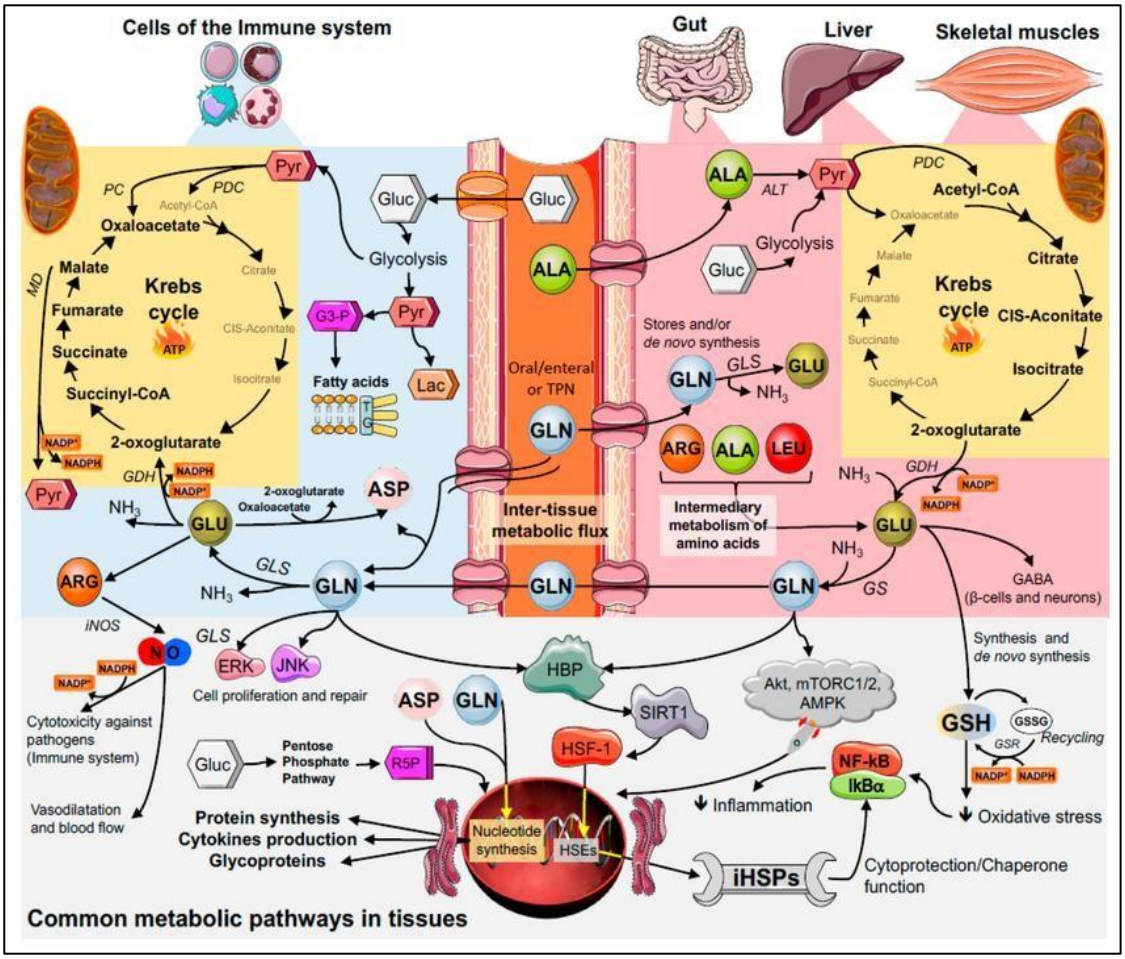


"The change of glutamine to glutamate is an important metabolic step, as it provides intermediates for the TCA cycle, such as 2-oxoglutarate. In organs such as the liver,

immune system and muscle, glutamine" holds a critical part in nitrogen transport, cells proliferation, & the synthesis of nucleotides and proteins (Figure 3/4).

However, in catabolic or hypercatabolic conditions, such as sepsis, trauma, or cancer, the demand for glutamine increases, leading to its increased consumption by immune cells and tissues like the gut. "This increase in demand often leads to a decrease in plasma glutamine concentration, making it a conditionally essential amino acid in such states. The balance between glutamine synthesis and consumption is influenced by hormonal signals and the catabolic status of the body."[37,39,40,41]

Figure 4: "Glutamine inter-tissue metabolic flux starting in skeletal muscle, liver, and gut continues in the immune cells."[37-41]



Physiological Role of Glutamine in Various Systems:

"Glutamine plays a crucial role in the **immune system**, acting as a key energy source for rapidly dividing immune cells, including "lymphocytes and macrophages". It supports lymphocyte proliferation, cytokine production, and macrophage phagocytic function, thereby enhancing host defence mechanisms. Research highlights that, glutamine depletion impairs immune responses, leading to increased susceptibility to infections and delayed recovery in critically ill patients. Additionally, glutamine supplementation has been shown to modulate inflammation and improve clinical outcomes in immunocompromised states, such as sepsis and post-surgical recovery."

- In the **gastrointestinal system**, "glutamine acts as a vital energy substrate for enterocytes, contributing to gut barrier integrity and mucosal repair. It maintains tight junctions between intestinal epithelial cells, preventing bacterial translocation and systemic infections. Studies have demonstrated that glutamine supplementation reduces intestinal permeability and protects against conditions such as inflammatory bowel disease and chemotherapy-induced mucositis. Its role in modulating gut microbiota composition further underscores its significance in maintaining gastrointestinal homeostasis."

- Within the **muscular system**, "glutamine plays a pivotal role in protein synthesis and nitrogen balance. It serves as a reservoir of nitrogen for anabolic processes, facilitating muscle growth and repair. In catabolic states such as trauma, sepsis, and prolonged exercise, muscle glutamine stores are rapidly depleted, leading to muscle wasting and impaired recovery." Research suggests that glutamine supplementation mitigates muscle protein breakdown, enhances post-exercise recovery, and supports muscle endurance by replenishing intramuscular glutamine pools.

- **"Central nervous system" (CNS)**, the key precursor in the "glutamate-glutamine cycle" is glutamine, which is essential for neurotransmitter balance. "It regulates excitatory and inhibitory signalling by facilitating the synthesis of glutamate and gamma-aminobutyric acid (GABA). Dysregulation of glutamine metabolism has been implicated in neurodegenerative disorders, including Alzheimer's and Parkinson's disease." Evidence suggests that glutamine supplementation may have neuroprotective effects by modulating synaptic plasticity, reducing neuroinflammation, and preventing excitotoxicity.

- Glutamine also exerts a crucial **antioxidant function** as a precursor for glutathione, one of the most potent intracellular antioxidants. Glutathione is essential for neutralizing reactive oxygen species (ROS) and safeguarding cells against damage caused by oxidative stress. In diseased conditions such as malignancy, diabetes, and cardiovascular diseases, glutamine availability directly influences glutathione synthesis and redox homeostasis. Clinical studies indicate that glutamine supplementation enhances antioxidant defences, reduces "oxidative stress", and improves outcomes in severely diseased with oxidative damage.

These diverse physiological functions emphasise that "glutamine is an essential amino acid, particularly during metabolic stress when endogenous production is inadequate". Ongoing research continues to explore its therapeutic applications across various clinical domains.

Pathophysiology of glutamine deficiency:

"Glutamine, a conditionally essential amino acid, plays a crucial role in maintaining cellular homeostasis, immune function, and nitrogen balance."[10] In severely ill , glutamine deficiency arises due to increased metabolic demands and impaired endogenous synthesis, leading to profound physiological consequences.[42,43] Studies have shown that, during critical illness, "catabolic stress induced by systemic inflammation, oxidative stress, and metabolic derangements accelerates glutamine depletion. The high energy demands of rapidly dividing "immune cells, such as lymphocytes and macrophages further exacerbate this depletion, compromising immune function and increasing susceptibility to infections.[7,35] Moreover, glutamine serves as a primary energy source for enterocytes, preserving intestinal barrier integrity." Deficiency in glutamine disrupts the gut mucosal barrier, predisposing patients to bacterial translocation and systemic infections, which can significantly impact morbidity and mortality. Research has demonstrated that critically ill pediatric patient's presented with reduced plasma glutamine levels, correlating with disease severity and adverse clinical outcomes.[44,45] Furthermore, glutamine is essential for maintaining acid-base balance by participating in renal ammonia genesis.[46] A deficiency impairs the kidney's ability to excrete acid, potentially exacerbating metabolic acidosis, a common problem in severly ill children. Some studies have suggested that exogenous glutamine supplementation may improve clinical outcomes by enhancing immune function, reducing infection rates, and preserving gut integrity, although findings remain inconsistent across various trials.[47,48,49] Despite the potential benefits, routine glutamine supplementation is not universally recommended due to conflicting evidence and the need for individualized patient assessment.

Risk factors:

- Premature birth.
- Low birth weight.
- Chronic illnesses (such as cystic fibrosis, cancer).
- Severe infections or sepsis.
- Malnutrition and poor dietary intake.
- Prolonged hospitalization.
- Intestinal disorders (like short bowel syndrome, inflammatory bowel disease).
- Post-surgical stress or trauma.
- Burns and severe injuries.
- Immunodeficiency conditions.

Causes:

- **Inadequate dietary intake** (low protein diet, malnutrition).
- **Increased demand** due to stress, infection, or illness.
- **Gastrointestinal disorders** (malabsorption, chronic diarrhoea).
- **Metabolic disorders** affecting glutamine synthesis.
- **Excessive loss** through urine in renal dysfunction.
- **Prolonged parenteral nutrition** without glutamine supplementation.

Etiology:

- **Endogenous depletion** due to increased metabolic demand.
- **Inadequate synthesis** in conditions of stress, inflammation, or catabolism.
- **Genetic factors** affecting glutamine metabolism.
- **Secondary deficiency** due to underlying diseases (e.g., liver disease, kidney disease).

Prevalence of glutamine deficiency worldwide:

- Research done in the "North West province of South Africa reported that approximately 38% patients are glutamine deficient upon admission to the ICU, while some exhibited supra-normal levels."[50]

- Similarly, Ekmark et al.[19] observed that plasma glutamine reduction was detected in forty per cent of patients upon "admission" to the PICU, and this deficiency was significantly linked to multiple system failures.

- Research by **Ekmark L, et al.,**[19] showed that the occurrence of low plasma glutamine levels was fifty-nine per cent at baseline, and even by day seven, half of the participants continued to exhibit reduced glutamine levels. Comparing these findings with other international studies, the reported prevalence of glutamine deficiency varies considerably.

- Research conducted in the **Netherlands** documented a prevalence of 65% in one study[51] 55% in another[52] and 31% in a separate investigation.[20]

- A **Swedish** study reported a deficiency rate of 44%, [21]whereas research from **Japan** reported a prevalence of 33%.[53] (Tsujimoto, T.). These findings consistent with the 38% prevalence reported in **South African ICU** patients.[50]

- "Further insights into the nutritional status of critically ill children highlight the significant burden of malnutrition in this population. An **Indian** study reported that, 51.2% of critically ill children were malnourished, with an overall mortality rate of 38.8%."[54]

- "In a prospective study involving 385 children admitted to the PICU, **De Souza et al.,**[55] observed a malnutrition incidence of 45.5%. Another study from **India** by **Chaitra et al.**,[56] demonstrated that 55% of critically ill children admitted to the PICU had a suboptimal nutritional status."

These scenarios from different studies highlighted the presence of glutamine deficiency in developed and developing countries. Therefore, in health care settings, probable implications of treatment modalities, nutritional assessment and intervention in ICU and PICU for critically ill patients are urgently needed.

Clinical Significance of Glutamine(Gln) Deficiency in Critically - Ill Children:

1. "Gln plays important role in gluconeogenesis." [11,12]

2. Some previous shreds of evidence reported that Gln have the ability to "improve insulin sensitivity and glucose disposal in patients suffering from critical illness a condition often linked to insulin resistance and hyperglycemia." [57,58]

3. Research suggests that "glutamine deficiency in pediatric intensive care patients is associated with increased morbidity and mortality due to impaired immune response, oxidative stress, and compromised intestinal barrier function, leading to sepsis and multiorgan failure."[59, 60]

4. Critically ill children, especially those with severe infections, burns, trauma, or undergoing major surgery, often exhibit depleted glutamine levels, correlating with prolonged hospital stays and poor clinical outcomes.[59,61] Although, glutammine addition has been explored as a promising therapeutic strategy, findings remain inconclusive, with some studies demonstrating

improved immune function and reduced infection rates, whereas others show no significant impact on survival.

5. The clinical significance of glutamine deficiency emphasizes, the need for individualized nutritional interventions to optimize recovery and reduce complications in critically ill pediatric patients.

Critical Illness and Glutamine Deficiency: Disease-Specific Considerations:

1. **Glutamine levels in septic shock:**

   Prominent research states, children with septic shock experience a significant reduction in circulating glutamine levels, showing depletion of this amino acid during severe infections.[62]

2. **Glutamine metabolism in burns and trauma patients.**

   The hypermetabolic reaction brought on by significant tissue damage causes glutamine metabolism to profoundly dysregulate in burn and traumatic injury patients. Endogenous glutamine stores are quickly depleted as a result of this increased metabolic requirement, jeopardizing vital physiological processes. Glutamate is an essential substrate for immune cells, and a lack of it can weaken the immune system and make people more prone to infections. Furthermore, glutamine deficiency increases muscle catabolism, which leads to severe muscular atrophy, and inhibits collagen synthesis and fibroblast activity, which delays the healing of wounds. Given its critical function in tissue repair and cellular proliferation, glutamine supplementation shows promise as a therapeutic strategy to reverse these negative effects and provide vital metabolic support for the healing process.[63,64,65]

Impact on Neonatal and Pediatric Surgical Patients:

Critically ill neonates and pediatric surgical patients experience substantial metabolic stress, leading to altered glutamine metabolism. Premature infants, in particular, have limited endogenous glutamine synthesis, making them more susceptible to deficiencies.[4,66] In neonates undergoing major surgeries, low glutamine levels have been linked to impaired immune function, increased intestinal permeability, and higher infection rates.[67] The potential role of glutamine supplementation in reducing postoperative complications and improving clinical outcomes is an area of active research, with preliminary findings suggesting benefits in reducing nosocomial infections and supporting gut integrity.

3. **Role in Multiorgan Dysfunction Syndrome (MODS) and Critical Illness-Related Immune Suppression:**

Glutamine deficiency in severly ill patients contributes to the development of multiorgan dysfunction syndrome (MODS) and immune dysregulation.[68,69,70] As a key component for "glutathione" synthesis, glutamine helps mitigate oxidative stress and inflammation, both of which are hallmarks of MODS. Additionally, it plays a crucial role in lymphocyte proliferation, cytokine production, and gut-associated lymphoid tissue (GALT) function. In critical illness-related immune suppression, low glutamine levels exacerbate immune dysfunction, increasing the risk of secondary infections and poor clinical outcomes. While glutamine supplementation has been explored as a strategy to mitigate MODS, results remain inconclusive, highlighting the need for further research.[71]

Correlation with Nutritional Status and Malnutrition in Critically Ill Children:

Malnutrition is a significant concern in critically ill pediatric patients, with glutamine depletion serving as both a marker and contributor to poor nutritional status. Critically ill children often exhibit reduced glutamine levels due to increased metabolic demand, prolonged catabolism, and inadequate nutritional support. This deficiency impairs gut barrier function, increases susceptibility to infections, and prolongs hospital stays. Studies have investigated the role of oral and intravenous glutamine addition in improving nutritional outcomes and reducing morbidity in malnourished pediatric patients, though optimal dosing and timing remain areas for further investigation.[72,73,74]

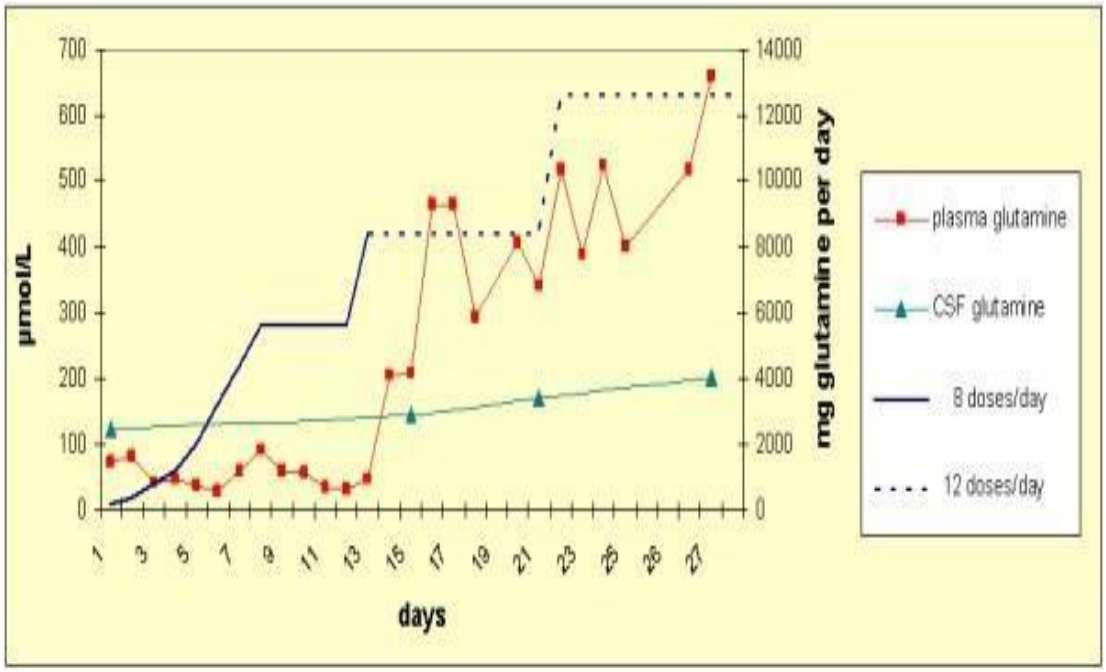
Methods for Measuring Glutamine Levels in Severely Ill Patients:

Research on severely ill patients employs various techniques to measure glutamine levels, aiding in the assessment of metabolic status and nutritional demands. Plasma glutamine concentration is the most commonly used biomarker, typically measured using "high-performance liquid chromatography (HPLC) or liquid chromatography-mass spectrometry (LC-MS)", both of which offer high specificity(Sp) and sensitivity(Sn).[20,21] Enzymatic assays, utilizing glutaminase-based reactions, provide a cost-effective and rapid alternative, though they may lack the precision of chromatographic methods. Additionally, point-of-care testing devices are being explored for real-time monitoring, especially in intensive care settings where timely assessment is crucial. Some studies also utilize nuclear magnetic resonance (NMR) spectroscopy for more comprehensive metabolic profiling. Given the dynamic nature of glutamine (Gln) metabolism in severely ill patients, serial measurements are often recommended to track fluctuations and guide clinical interventions effectively.

Role of Glutamine Supplementation in Pediatric Critical Care:

"Glutamine, a conditionally essential amino acid, plays a crucial role in metabolic processes, immune function, and intestinal integrity, particularly in critically ill children. During critical illness, glutamine depletion occurs due to increased metabolic demands, leading to compromised immune responses, impaired gut barrier function, and increased susceptibility to infections. Research has explored the potential benefits of glutamine supplementation in pediatric critical care settings, focusing on its role in reducing morbidity and improving clinical outcomes. According to the **Häberle, J., et al.,**[49] L-glutamine supplementation was administered in a controlled and stepwise manner to ensure safety and efficacy in critically ill patients. The powdered form of L-glutamine was initially introduced at a conservative dose of 17 mg/kg/day, divided into eight separate administrations. This cautious initiation aimed to mitigate potential risks associated with elevated ammonia and glutamate levels, which could lead to neurotoxicity. As tolerance was established, the dosage was progressively escalated, reaching a peak of 1020 mg/kg/day by the 21st day of the trial."

Figure 5 : "In a child with inherited glutamine synthetase (GS) deficiency, supplementation improves clinical status and partially restores the central and peripheral amino acid balance."[49]



During the initial two weeks, fasting plasma glutamine levels did not exhibit a significant rise, prompting an adjustment in the administration schedule. To optimize absorption and maintain more stable plasma concentrations, the interval between individual doses was reduced to two-hour intervals. (Figure) Furthermore, to enhance compliance and facilitate treatment administration, a continuous enteral infusion strategy was implemented. "From 12 p.m. to 8 a.m., a total of 330 mg/kg glutamine was delivered via a gastrostomy pipe after dilution in a hundred millilitre of water. Prior to the extended infusion protocol, the stabillity of the glutamine soln. was verified by measuring its concentration at intervals of 0, 6, and 9 hours. These assessments confirmed a consistent glutamine concentration throughout the infusion period, ensuring the integrity of the administered solution."

To investigate the parenteral glutamine dose required to sustain normalized plasma levels, an intravenous supplementation protocol was incorporated. “L-glutamine was infused continuously over six hours at rates of twenty-one mg/kg/h and thirty-one mg/kg/h, respectively. Subsequently, an extended infusion over 8 hours was conducted at a rate of forty-one mg/kg/h. During these parenteral administrations, oral glutamine supplementation was temporarily withheld to precisely assess the parenteral requirements for maintaining plasma glutamine homeostasis. This structured supplementation approach provided valuable insights into the optimal delivery methods for glutamine in critically ill patients, balancing efficacy with safety.”

Preventive Measures for Glutamine Deficiency in Critically Ill Children

1. **Early Nutritional Assessment:**
    - Regular evaluation of nutritional status upon ICU admission.
    - Monitoring glutamine levels and overall protein intake.
2. **Adequate Protein and Caloric Intake:**
    - Ensure sufficient protein intake (1.5–3 g/kg/day based on age and condition).
    - Provide balanced calories to prevent catabolism.
3. **Enteral Nutrition (EN) Optimization:**
    - Prefer enteral over parenteral nutrition when feasible.
    - Use glutamine-enriched formulas for high-risk patients.
4. **Parenteral Nutrition (PN) Supplementation:**
    - Consider glutamine-enriched PN for children unable to tolerate enteral feeds.
    - Maintain optimal amino acid balance to support immune function.

5. **Early Initiation of Feeding:**
    - Start oral or intravenous nutrition within 1-2 days of ICU.
    - Gradually advance feeding to meet full nutritional needs.
6. **Immune Supportive Nutrition:**
    - Supplement with antioxidants, vitamins (C, E), and trace elements (zinc, selenium) to support metabolism.
7. **Monitoring and Managing Catabolic Stress:**
    - Control underlying conditions that increase glutamine demand (sepsis, burns, trauma).
    - Avoid prolonged fasting and excessive glucose infusion.
8. **Use of Glutamine Supplements:**
    - Consider oral or intravenous addition of glutamine in severely diseased.
    - Dosage should be based on clinical guidelines and patient tolerance.
9. **Preventing and Treating Infections:**
    - Strict infection control to reduce metabolic stress and glutamine depletion.
    - Early antibiotic stewardship to minimize prolonged inflammation.
10. **Regular Biochemical Monitoring:**
    - Track serum glutamine levels, nitrogen balance, and metabolic markers.
    - Adjust nutritional strategies based on patient response.
11. **Minimizing Unnecessary Prolonged Mechanical Ventilation:**
    - Reduce duration of mechanical ventilation to lower metabolic stress.
    - Implement weaning protocols to improve overall metabolic function.

12. **Addressing Gut Integrity and Microbiome Health:**
    - Probiotics and prebiotics to maintain gut barrier function.
    - Avoid unnecessary use of broad-spectrum antibiotics that can disrupt gut flora.
13. **Individualized Patient Care Plans:**
    - Tailor nutritional interventions based on age, disease severity, and metabolic needs.
    - Involve a multidisciplinary team including pediatric intensivists, dietitians, and pharmacists.

Summary of previous investigation related to the current study:

Blaauw R, et al.,[44] demonstrated that, significant proportion (59%) of 330 critically ill patients in South African ICUs had low plasma glutamine levels, with the lowest seen in polytrauma and sepsis cases and the highest in liver failure. Marker of inflammation and infection (CRP, albumin), and disease severity (APACHE II, SOFA) correlated with hypoglutaminemia, though clinical outcomes were largely unaffected except for the increased need for mechanical ventilation.

"A study investigated by **Ekmark et al.,**[19] on 149 critically ill children that the relationship between plasma glutamine levels and multiple organ failure in critically ill children and found that 40% of paediatrics patients admitted to the PICU had plasma glutamine concentrations below optimal levels. These lower levels were significantly linked with multiple organ dysfunction, as calculated by the "Paediatric Logistic Organ Dysfunction (PELOD) score". Interestingly, for patients who remained in the PICU for more than five days, plasma glutamine levels tended to normalize after few days, a pattern differing from that observed in adult Intensive care unit patients. This highlights that while an initial deficiency in "plasma

glutamine" is linked to MODS in critically ill children, their bodies may compensate over time. Hence the importance of monitoring plasma glutamine levels upon PICU admission to identify children at higher risk for organ failure."

"**Rodas PC et al**.,[21] conducted a study on glutamine deficiency in 174 critically ill children, emphasizing its role in immune function, gut integrity, and metabolic response to stress. Glutamine levels will become deficient during critical illness due to increased catabolism and insufficient endogenous production, which indicates that low glutamine levels are associated with higher morbidity, prolonged hospital stays, and increased mortality in critically ill paediatric patients. Supplementation has been explored to improve clinical outcomes in terms of reducing infections and hospital stays, while others report no significant improvement. So there is need to underscores the need for individualization of patient selection for glutamine supplementation in critically ill children**."**

An extensive study done by **Mette M. Berger and colleagues**[75] on the role of glutamine in 20 burns patients over 1 year, emphasizing its critical function in immune response, gut integrity, and protein metabolism. Burns induce a hypermetabolic state, leading to significant glutamine depletion, which can compromise immune function and increase susceptibility to infections and sepsis. Several "clinical trials and meta-analyses indicate that glutamine supplementation, whether enteral or parenteral, can improve patient outcomes by reducing infection rates, preserving gut mucosal integrity, and enhancing nitrogen balance." However, while some patients report positive impacts on mortality and hospital stay, others show inconsistent results, suggesting there is need of further large-scale, well-controlled trials. Overall, there are potential benefits of glutamine supplementation in burn management.

As per **Roth et al.,**[36] sepsis leads to significant depletion of glutamine in skeletal muscle, which may impair immune function, protein formation, and energy utilisation. As we know "glutamine acts as a crucial fuel source for fast-proliferating cell, particularly immune cells and enterocytes. Its deficiency in sepsis is associated with muscle wasting, reduced antioxidant capacity, and impaired nitrogen balance." This will insinuate that this metabolic adaptation resembles a hibernation-like state, where the body conserves energy and prioritizes vital functions. However, there is debate about exact mechanisms linking glutamine depletion to this state, however there is substantial evidences are there regarding the benefits of its supplementation.

"A double-blind, randomized controlled trial" by **Sampurna M, et al.,**[76] on 37 LBW infants assessed the effects of enteral glutamine supplementation. Infants receiving glutamine achieved birth weight faster (8.1 ± 0.9 vs. 11.0 ± 1.6 days) and had a higher weight gain velocity than the placebo group. Additionally, serum IgA levels increased significantly in the glutamine group. These findings suggest that enteral glutamine accelerates weight recovery and enhances immune function in LBW infants."

"A systematic review and meta-analysis" by **Sun Y, et al.,** [77] included 47 randomized controlled trials with 6,198 patients. It found no significant difference in hospital mortality between the glutamine and control groups. However, the control group had a longer length of mechanical ventilation. In severely burned patients, mortality followed the same trend. It concluded that, glutamine supplementation should be used judiciously routinely to the diet of critically ill patients, except for those with severe burns."

"Furthermore, **Wang Y, et al.,**[78] examined 30 premature infants to evaluate the impact of parenteral nutrition (PN) supplemented with glutamine on premature infants showed with an extended duration of parenteral nutrition, hepatic dysfunction worsened. However, parenteral glutamine supplementation appeared to offer a hepatoprotective benefit, suggesting that it may play a crucial role in mitigating the adverse effects on liver function in premature infants."

"Smedberg M, et al., (2021)[79] conducted an extensive investigation involving 269 critically ill patients admitted to the ICU. Among these, 26 individuals exhibited hyperglutaminemia, characterized by plasma glutamine levels equal to or exceeding 930 µmol/L at the time of admission. Further it underscored the significant prognostic implications of hyperglutaminemia, identifying it as an independent predictor of mortality in severe pateints. While hyperglutaminemia was frequently associated with acute liver conditions, it was not an absolute determinant of hepatic dysfunction, suggesting a multifaceted underlying pathophysiology. Despite these insights, the precise mechanisms responsible for deviations in plasma glutamine levels remain inadequately understood. Furthermore, the potential prognostic value of serial glutamine measurements throughout the course of ICU hospitalization necessitates further studies to improve treatment procedure and improve patient outcomes."

MATERIALS AND METHODS

- **Source of data:** Children above 1 month and below 18 years admitted in paediatric emergency in "KLE Dr. Prabhakar Kore Hospital and research centre, Belagavi".

- **Study design:** "Cross-sectional observational study."

- **Study period:** 1 year. (AUGUST 2023 – JULY 2024)

- **Sample size:** Sample size at 95% confidence interval, 20% tolerability error and 10% attrition rate.

$$n = \frac{[Z1-\alpha/2]\ P\ (1-P)\ X\ 1.10}{(20\%\ of\ prevalence)^2}$$

Z1- α/2=1.96

Prevalence of low glutamine level -44%

$$n = \frac{[1.96x44(56)]\ x1.10}{(20\%\ of\ 44)^2}$$

n=124

with attrition rate of 10%.

Required sample size: 136 + 36 (added later during the course of research to get more precise results)

Sampling technique: A simple random sampling every 4th subject will be taken.

Inclusion criteria:

1. All patients who are admitted in paediatric emergency in "Dr. Prabhakar kore hospital and research centre, Belagavi."
2. Age above 1 month to below 18 years.

Exclusion criteria:

1. Patients suffering from "inborn error of metabolism."
    a) "Maple syrup urine disease."
    b) Phenylketonuria.
    c) Tyrosinemia.
    d) Homocystinuria.

Data collection procedure:

"In the present study, institutional ethical approval was taken from critically ill children (1 month–18 years) who were admitted to a tertiary hospital's emergency department. Eligibility was based on WHO-defined critical illness, including severe airway, breathing, or circulatory dysfunction, or acute neurological deterioration. Specific conditions included sepsis, upper airway obstruction, hypoxemia (SpO_2 <90%), central cyanosis, severe respiratory distress, inability to feed, or shock (cold extremities, capillary refill time >3s, weak rapid pulse).

For children aged seven to twelve years, verbal or oral consent was obtained, while for those aged 12 to 18 years, written consent was collected and signed by the participants and their parents or guardians. The purpose of the study and the procedures involved were explained in detail to all participants and their caregivers prior to data collection.

During the admission, detailed clinical data were recorded using a structured proforma. Blood specimen were collected on the first day of admission to measure glutamine levels. The analysis was performed using the E4078Hu Glutamine Assay Kit, based on the ELISA method. The glutamine levels obtained were correlated with the PRISM III score to evaluate their association with the severity of illness in the study population."

Data processing and analysis/statistical analysis:

After obtaining ethical clearance and informed consent and assent, glutamine levels were estimated and data was recorded using structured proforma and managed on an excel sheet. During the procedure, 3 ml venous blood samples were taken in heparinized vacutainer (EDTA), centrifuge samples for 15 minutes at 2000-3000 RPM for approximately 20 minutes and stored in -80° Celsius and processed in glutamine assay kit [E4078Hu] by ELISA method and correlate with PRISM III score.

Reagent preparation:

Prior to reagent preparation, ensure that all components are equilibrated to room temperature. The standard solution should be reconstituted by combining 120 µL of the provided standard (128 µg/mL) with an equivalent volume (120 µL) of the standard diluent, resulting in a standard stock solution with a final concentration of 64 µg/mL. This solution should be allowed to stand for approximately 15 minutes with gentle agitation to ensure homogeneity.

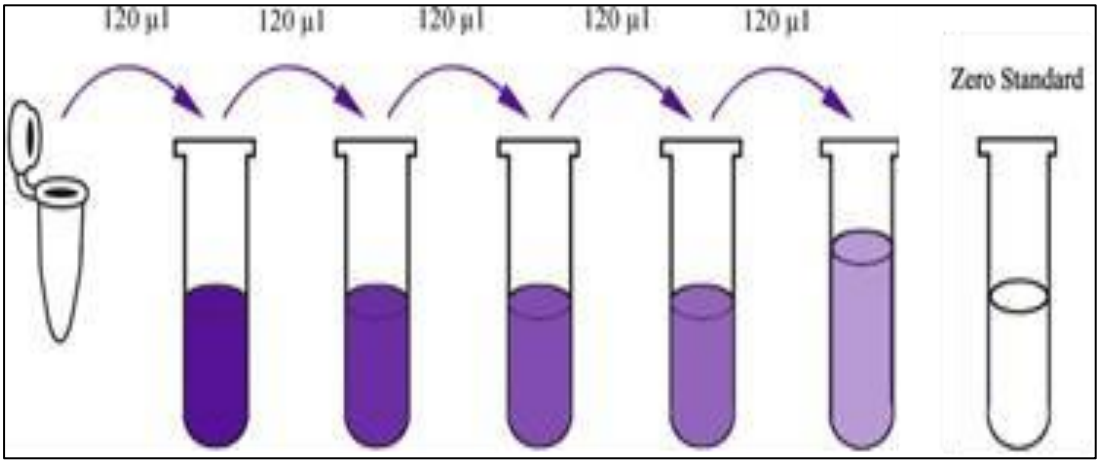
Subsequent serial dilutions of the standard stock solution (64 µg/mL) should be prepared in a 1:2 ratio using the standard diluent, generating a series of working

standards with concentrations of 32 µg/mL, 16 µg/mL, 8 µg/mL, and 4 µg/mL. The standard diluent alone serves as the zero standard (0 µg/mL). Any remaining standard solution should be stored at -20°C and used within one month to preserve its stability and accuracy. The recommended dilution protocol is as follows:

Figure 6: **Showing the dilution protocol**

64µg/ml	Standard No.5	120µl Original Standard + 120µl Standard Diluent
32µg/ml	Standard No.4	120µl Standard No.5 + 120µl Standard Diluent
16µg/ml	Standard No.3	120µl Standard No.4 + 120µl Standard Diluent
8µg/ml	Standard No.2	120µl Standard No.3 + 120µl Standard Diluent
4µg/ml	Standard No.1	120µl Standard No.2 + 120µl Standard Diluent

Figure 7: Dilutions



"Wash Buffer Dilute 20ml of Wash Buffer Concentrate 30x into deionized or distilled water to yield 500 ml of 1x Wash Buffer. If crystals have formed in the concentrate, mix gently until the crystals have completely dissolved".

Summary

1. Gather and prepare all necessary reagents, samples, and standards.
2. Dispense the sample and ELISA reagent into each well, then incubate at 37°C for 1 hour.
3. Wash the plate thoroughly five times.
4. Add substrate solutions A and B, followed by a ten-minute incubation at 37°C.
5. Introduce the stop solution to initiate color development.
6. Measure the optical density (OD) value within ten minutes.

Figure 8: Kit used for the glutamine assay.

- The present study involved conducting specific investigations on patients to gather crucial data essential for achieving the research objectives. Among these, blood investigations were central, focusing particularly on assessing serum glutamine levels.

  "The serum glutamine levels were measured using the Enzyme-Linked Immunosorbent Assay (ELISA) technique. This method, a highly sensitive and specific immunoassay, allowed the quantification of glutamine

concentrations in the blood. The ELISA technique involved the use of antibodies and colorimetric detection to identify and measure the presence of glutamine, ensuring precise results."

- The investigation required collecting venous blood samples from participants under aseptic conditions, ensuring patient safety and adherence to ethical standards. The samples were then processed and analysed in a laboratory equipped with the necessary ELISA apparatus. This investigation was vital to the study as it helped evaluate the metabolic or biochemical parameters under investigation, providing "valuable insights into the role of serum glutamine levels in the context of the study's focus."

- If there are any investigations / Interventions necessary which have to be conducted for completion of your study, in such situation who will bear the cost of the investigations.

MYSELF.

"Statistical analysis":

"A descriptive analysis was conducted using the mean and standard deviation for quantitative variables, while frequency and proportion were used for categorical variables. The data were also represented through appropriate diagrams, including bar diagrams, pie diagrams, and box plots. The association between quantitative explanatory variables was assessed using Pearson correlation and the t-test to determine statistical significance. A p-value of less than 0.05 was considered statistically significant. Statistical analysis was performed using IBM SPSS version 22"

RESULTS

Table 1: Descriptive analysis of age (years) in study population (N=172)

Parameter	Mean ± SD	Median	Minimum	Maximum	95% C.I	
					Lower	Upper
Age (Years)	7.7 ± 5.59	8.0	0.3	17.0	6.9	8.5

"Table 1 presents the descriptive statistics of age (in years) for the study population (N = 172). The mean age of the participants was 7.7 ± 5.59 years, with a median age of 8.0 years. The minimum and maximum ages observed in the cohort were 0.3 years and 17.0 years, respectively. The 95% confidence interval (CI) for the mean age ranged from 6.9 to 8.5 years, indicating a reliable estimate of the population mean."

Table 2: Descriptive analysis of gender in the study population (N=172)

Gender	Frequency	Percentages
Male	115	66.86%
Female	57	33.14%

Table 2 depicts the gender distribution among the study participants. Out of 172 individuals, 115 (66.86%) were male, while 57 (33.14%) were female. The male-to-female ratio suggests a higher proportion of males in the study cohort.

Figure 9: Pie chart of gender in the study population (N=172)

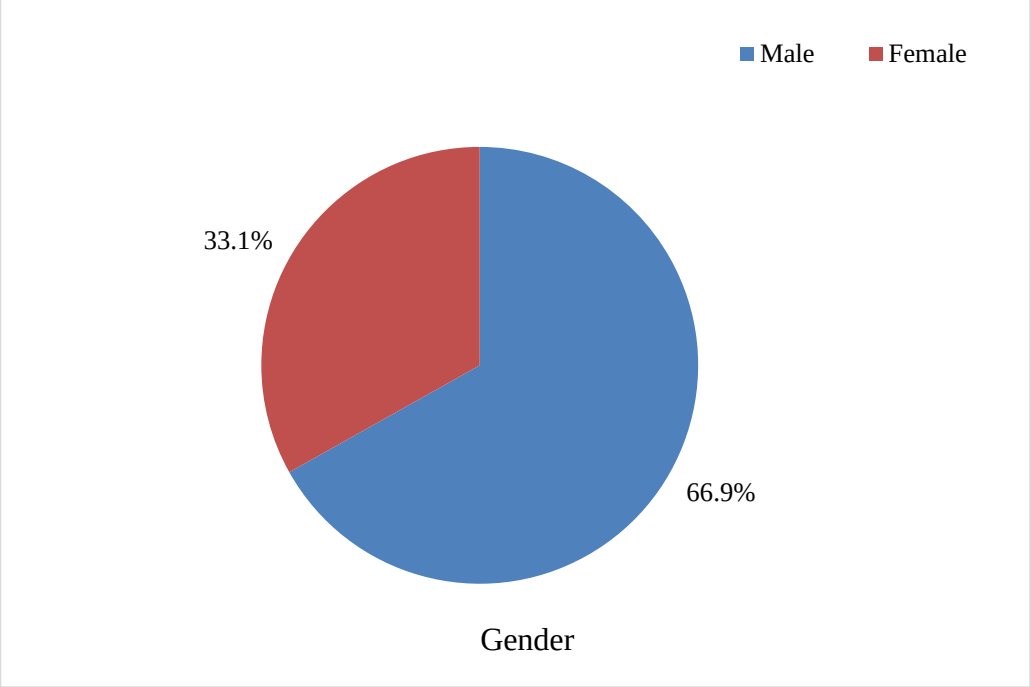


Table 3: Descriptive analysis of glutamine in the study population (N=172)

Glutamine	Frequency	Percentages
Deficiency	134	77.91%
Normal	38	22.09%

"Table 3 presents the distribution of glutamine levels among the study participants (N = 172).

Most of the individuals, 134 (77.91%), were found to have glutamine deficiency, while 38 (22.09%) had normal glutamine levels. This finding highlights a high prevalence of glutamine deficiency within the study population."

Figure 10: Pie chart of glutamine in the study population (N=172)

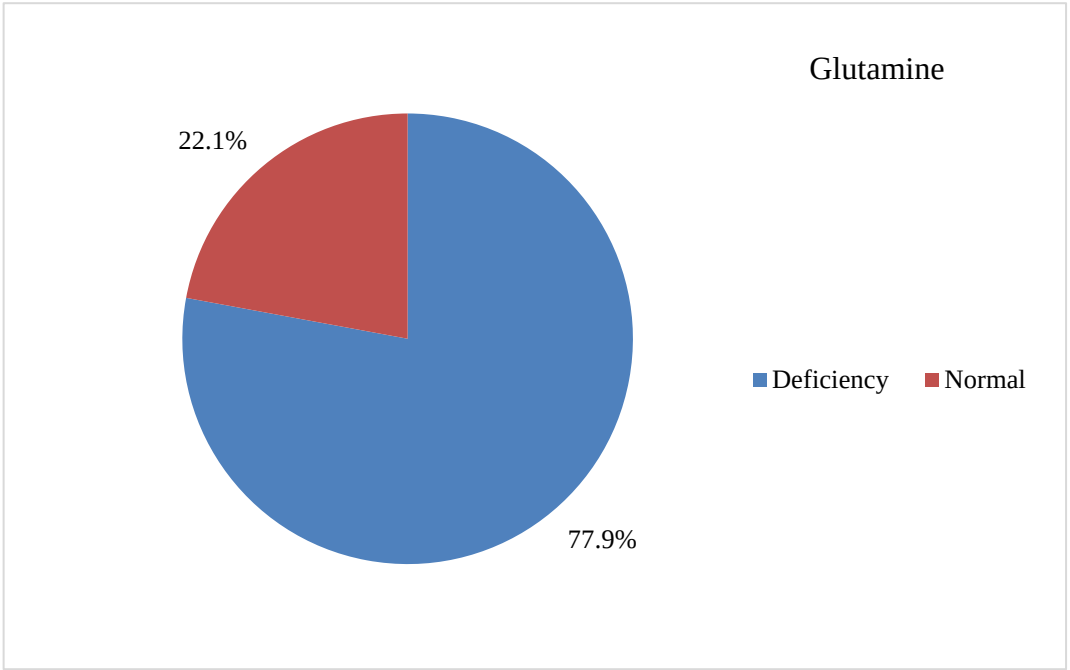


Table 4: Descriptive analysis of PRISM III score and glutamine (mmol/l), no. of days in PICU in study population (N=172)

Parameter	Mean ± SD	Median	Minimum	Maximum	95% C.I	
					Lower	Upper
PRISM III Score	4.55 ± 3.28	4.00	0.00	18.00	4.05	5.04
Glutamine (Mmol/L)	0.41 ± 0.21	0.35	0.10	1.14	0.38	0.44
No. Of Days in PICU	4.63 ± 2.72	4.0	1.0	15.0	4.2	5.0

"Table 4 summarizes the descriptive statistics for PRISM III score, glutamine levels (mmol/L), and the number of days in the Paediatric Intensive Care Unit (PICU) among the study population (N = 172)."

"The PRISM III score had a mean of 4.55 ± 3.28, with a median value of 4.00. The minimum and maximum PRISM III scores observed were 0.00 and 18.00, respectively. The 95% confidence interval (CI) for the mean score ranged from 4.05 to 5.04, indicating the distribution of severity scores among the participants."

"The glutamine level in the study population had a mean of 0.41 ± 0.21 mmol/L, with a median of 0.35 mmol/L. The values ranged from 0.10 mmol/L to 1.14 mmol/L, with the 95% CI for the mean glutamine level remaining between 0.38 and 0.44 mmol/L, reflecting a narrow variability in measurements."

"The number of days in the PICU had a mean of 4.63 ± 2.72 days, with a median stay of 4.0 days. The length of PICU stay ranged from 1.0 day to 15.0 days, with the 95% CI ranging between 4.2 and 5.0 days, indicating the overall distribution of hospitalization duration in the study population."

Table 5: Descriptive analysis of outcome in the study population (N=172)

Outcome	Frequency	Percentages
AMA	10	5.81%
Death	5	2.91%
Discharged	155	90.12%
Shift To OT	2	1.16%

Table 5 presents the distribution of patient outcomes in the study population (N = 172). Most patients, 155 (90.12%), were successfully discharged. A small proportion of cases, 10 (5.81%), left against medical advice (AMA), while 5 (2.91%) patients succumbed to their illness. Additionally, 2 (1.16%) patients were shifted to the operating theatre (OT) for further surgical intervention.

Figure 11: Bar chart of outcome in the study population (N=172)

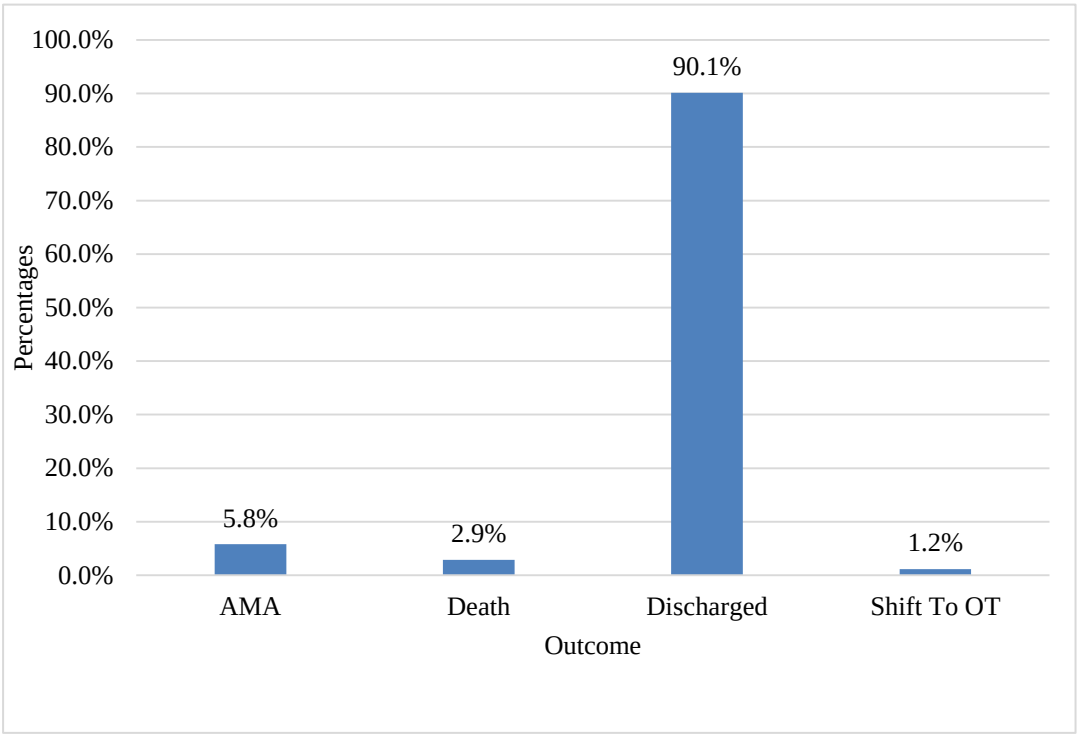


Table 6: Descriptive analysis of diagnosis in the study population (N=172)

Diagnosis	Frequency	Percentages
Respiratory System	45	26.16%
Central Nervous System	24	13.95%
Infectious	24	13.95%
Hepatic Biliary System	19	11.05%
Renal System	16	9.30%
Gastrointestinal System	13	7.56%
Cardiovascular System	9	5.23%
Endocrine And Metabolic	7	4.07%
Haematological System	4	2.33%
Miscellaneous	11	6.40%

Table 6 presents the distribution of diagnoses among the study population (N = 172). The most affected system was the respiratory system, accounting for 45 (26.16%) cases. This was followed by conditions related to the central nervous system (24, 13.95%), infectious diseases (24, 13.95%), and the hepatic biliary system (19, 11.05%).

Other diagnoses included renal system disorders (16, 9.30%), gastrointestinal conditions (13, 7.56%), and cardiovascular system diseases (9, 5.23%). Additionally, endocrine and metabolic disorders were observed in 7 (4.07%) cases, while haematological disorders accounted for 4 (2.33%) cases. A total of 11 (6.40%) cases fell under the miscellaneous category, comprising conditions that did not fit into the predefined classifications.

Figure 12: Bar chart of diagnosis in the study population (N=172)

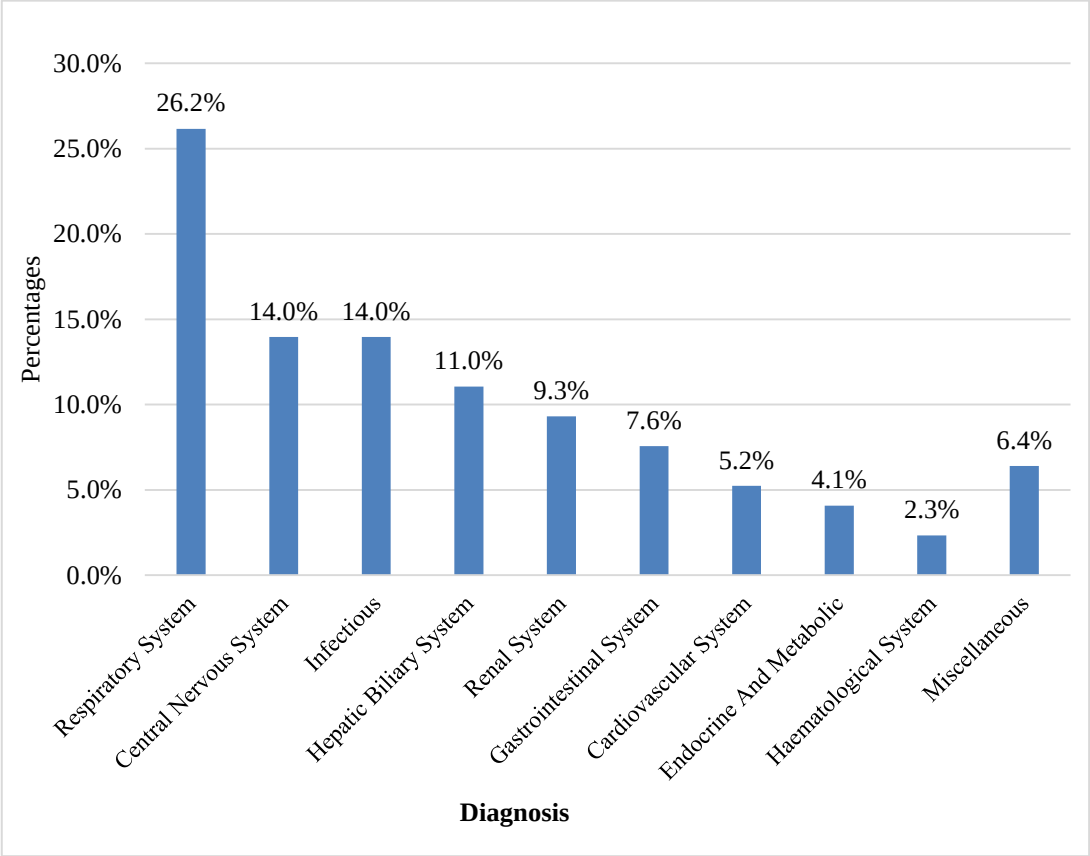


Table 7: Correlation of PRISM III score between and glutamine and No. of days in PICU in the study population (N=172)

Pairs	Pearson Correlation	P-value
PRISM III SCORE vs Glutamine (mmol/L)	-0.588	<0.001
PRISM III SCORE v No. of days in PICU	0.627	<0.001

Table 7 presents the correlation analysis between PRISM III score, glutamine levels (mmol/L), and the number of days in the PICU among the study population (N = 172).

"A moderate negative correlation was observed between PRISM III score and glutamine levels ($r = -0.588$, $p < 0.001$), indicating that higher PRISM III scores were associated with lower glutamine levels. This suggests a potential inverse relationship between disease severity and glutamine concentration."

"Conversely, a moderate positive correlation was found between PRISM III score and the number of days in the PICU ($r = 0.627$, $p < 0.001$), indicating that higher PRISM III scores were associated with prolonged ICU stays. This supports the predictive value of the PRISM III score in estimating the severity and length of hospitalization."

Figure 13: Scatterplot for correlation between PRISM III score and glutamine in the study population (N=172)

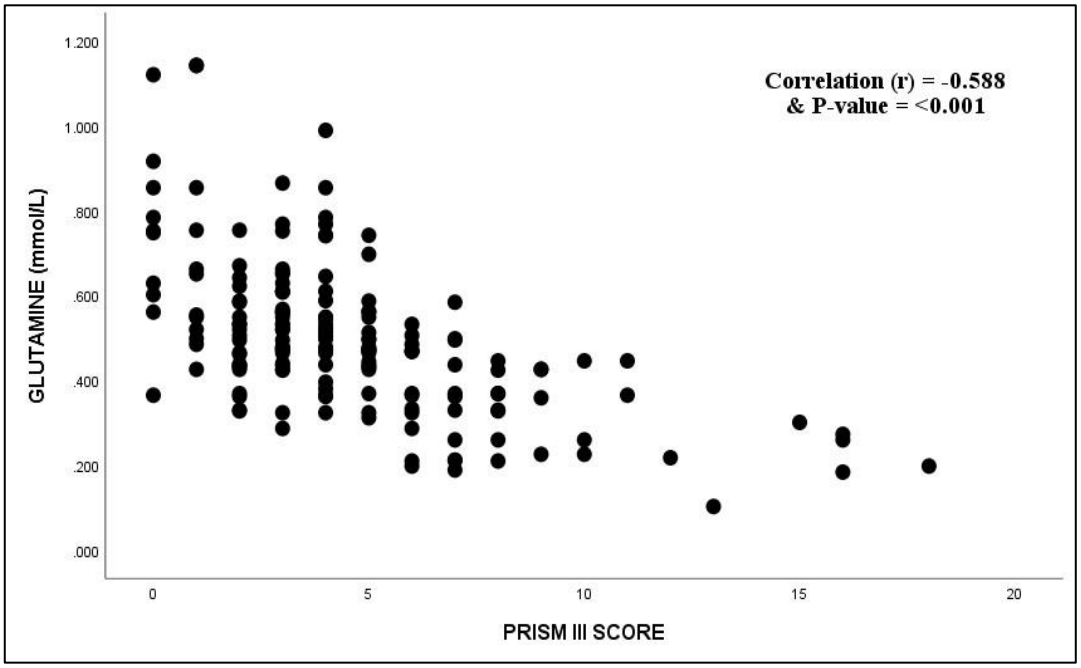


Figure 14: Scatterplot for correlation between PRISM III score and No. of days in PICU in the study population (N=172)

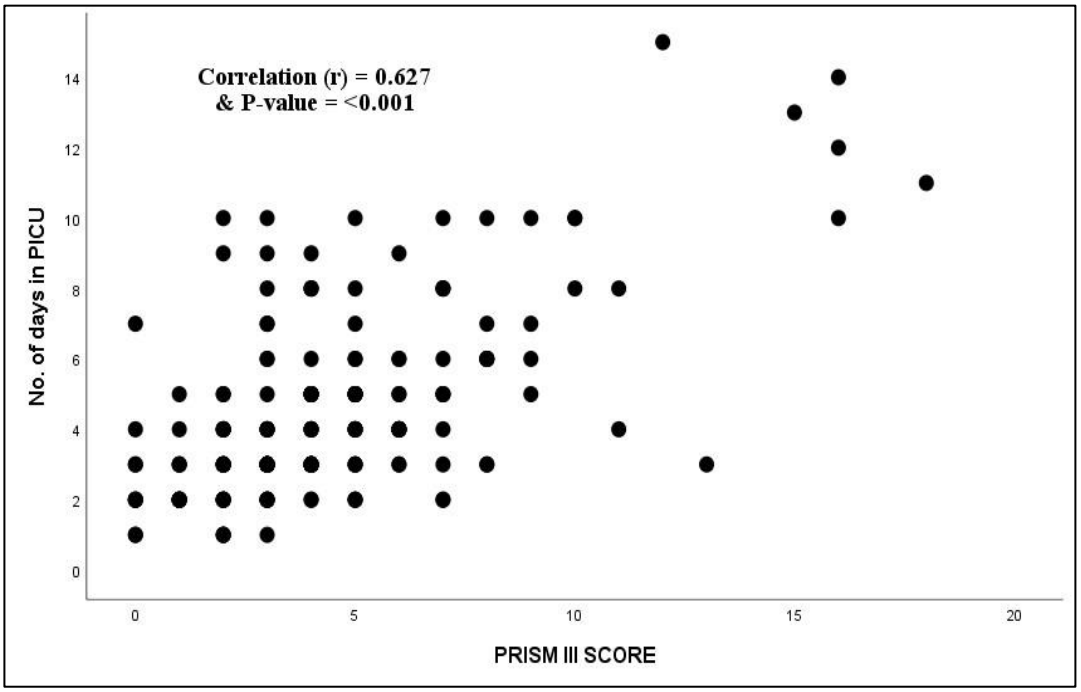


Table 8: Correlation of PRISM III score between and glutamine and No. of days in PICU in the Outcome population (N=172)

Pairs	Pearson Correlation	P-value
AMA (N=10)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.647	0.043
PRISM III SCORE v No. of days in PICU	-0.772	0.009
Death (N=5)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.780	0.120
PRISM III SCORE v No. of days in PICU	-0.329	0.589
Discharged (N=155)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.583	<0.001
PRISM III SCORE v No. of days in PICU	0.661	<0.001
Shift To OT (N=2)		
PRISM III SCORE vs Glutamine (mmol/L)	-	-
PRISM III SCORE v No. of days in PICU	-	-

Correlation of PRISM III Score with Glutamine Levels and Length of PICU Stay Based on Patient Outcomes

Table 8 presents the correlation analysis of PRISM III score, glutamine levels (mmol/L), and the number of days in the PICU, stratified by patient outcomes in the study population.

Patients Who Left Against Medical Advice (AMA) (N = 10)

"A strong negative correlation was observed between PRISM III score and glutamine levels ($r = -0.647$, $p = 0.043$), indicating that higher PRISM III scores were associated with lower glutamine levels. Additionally, a strong negative correlation was found between PRISM III score and the number of days in the PICU ($r = -0.772$, $p = 0.009$), suggesting that patients with higher PRISM III scores had shorter PICU stays before leaving against medical advice."

Figure 15: Scatterplot for correlation between PRISM III score and glutamine in the AMA population (N=10)

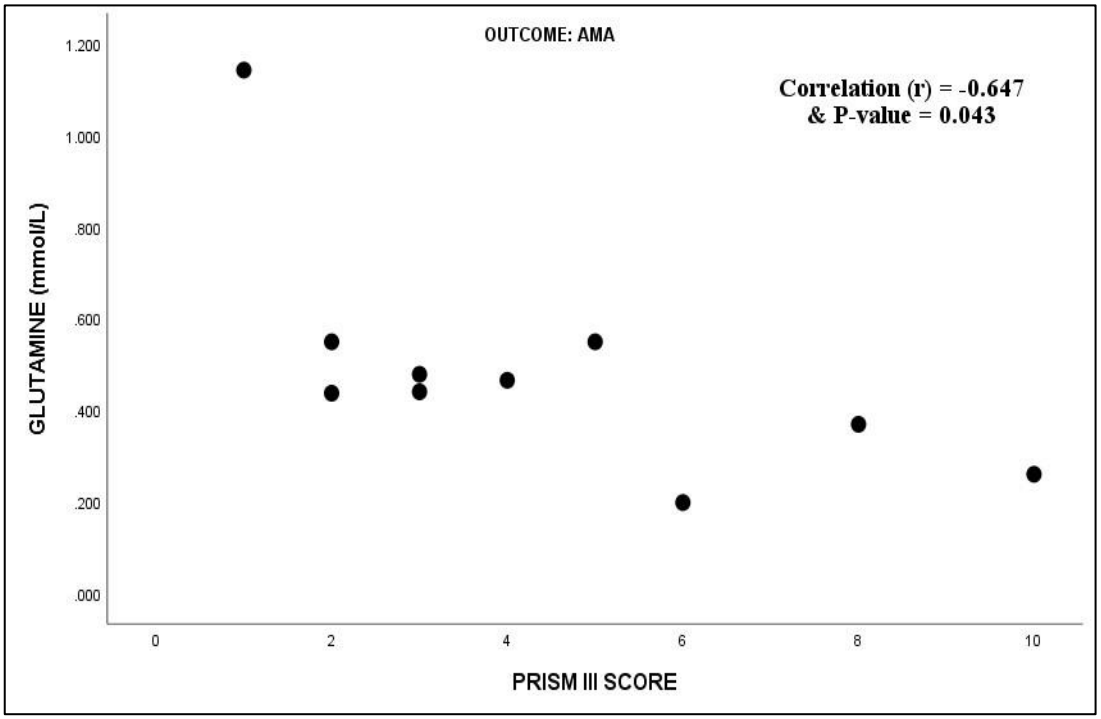
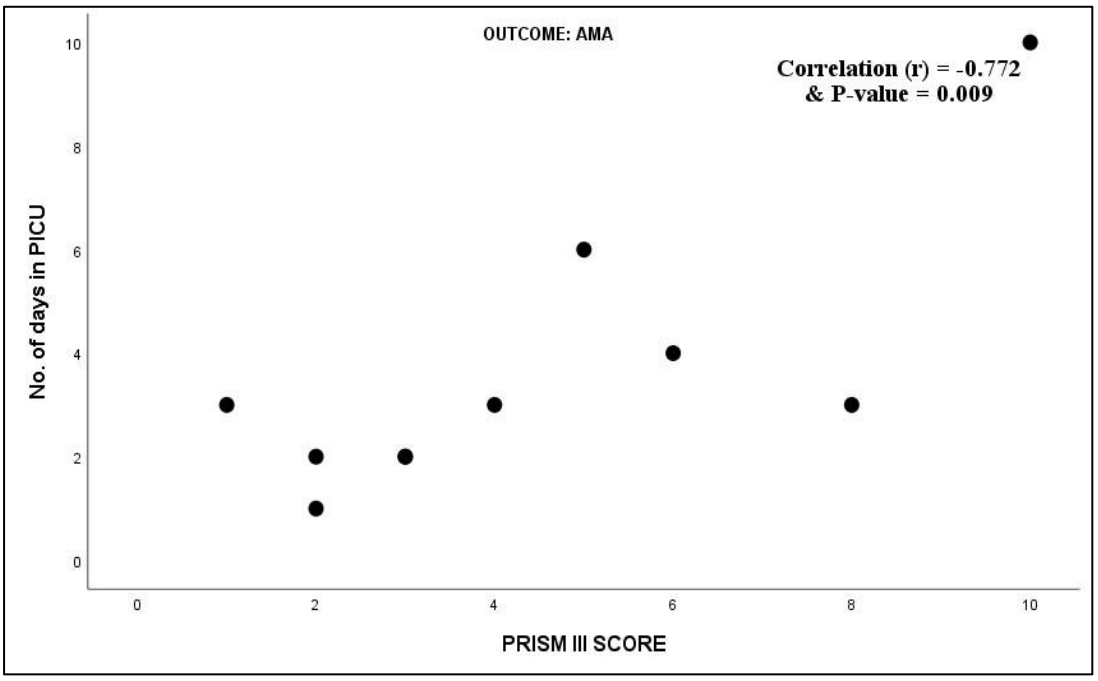


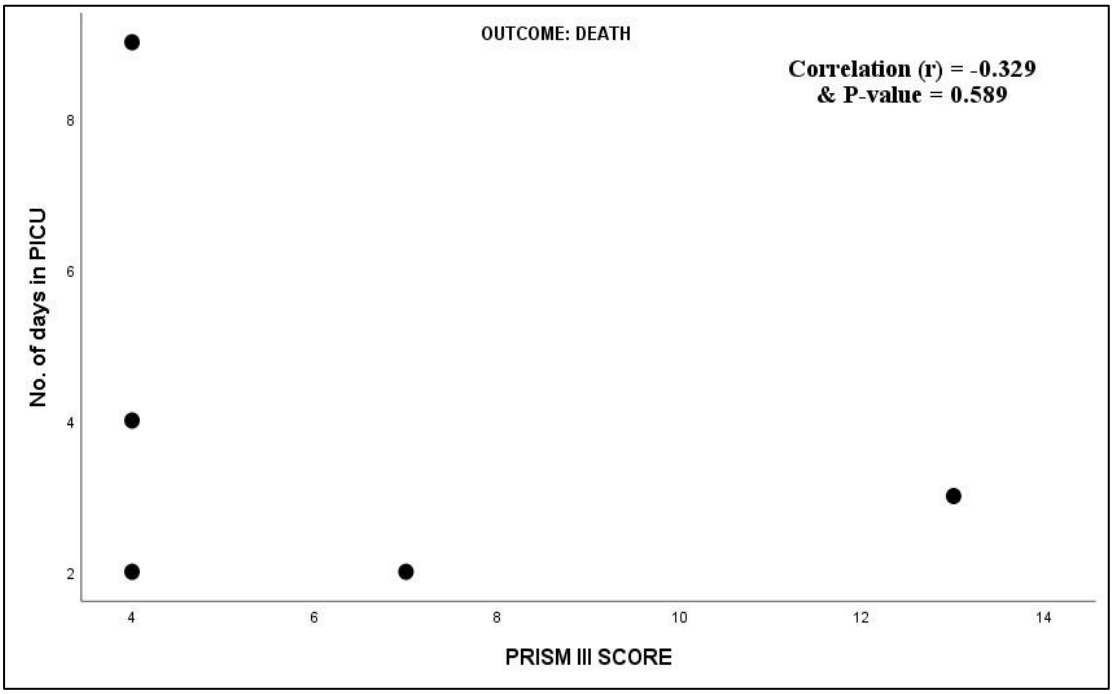
Figure 16: Scatterplot for correlation between PRISM III score and No. of days in PICU in the AMA population (N=10)



Patients Who Died (N = 5)

"A strong negative correlation was noted between PRISM III score and glutamine levels (r = 0.780, p = 0.120), although the result was not statistically significant. Similarly, the correlation between PRISM III score and the number of days in the PICU was weak and non-significant (r = -0.329, p = 0.589), indicating variability in hospital stay duration among non-survivors."

Figure 17: Scatterplot for correlation between PRISM III score and No. of days in PICU in the Dead population (N=5)



Patients Who Were Discharged (N = 155)

"Among discharged patients, a moderate negative correlation was found between PRISM III score and glutamine levels (r = -0.583, p < 0.001), reinforcing the trend of declining glutamine levels with increasing disease severity. Additionally, a moderate positive correlation was observed between PRISM III score and the number of days in the PICU (r = 0.661, p < 0.001), suggesting that patients with higher severity scores required longer intensive care."

Figure 18: Scatterplot for correlation between PRISM III score and glutamine in the Discharged population (N=155)

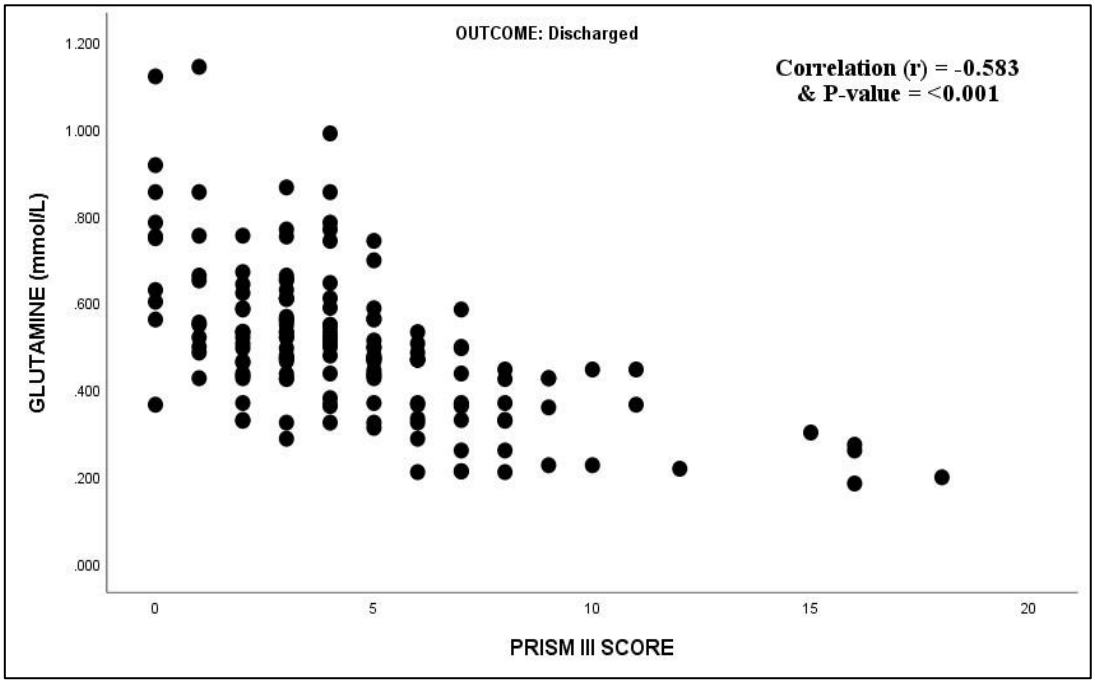
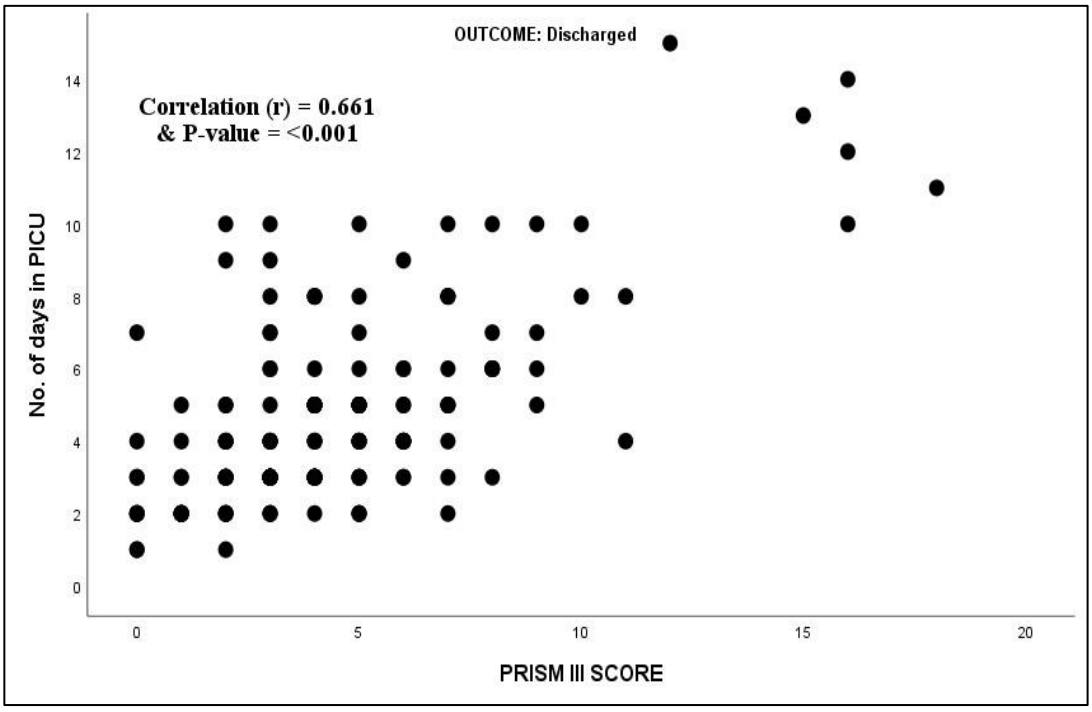


Figure 19: Scatterplot for correlation between PRISM III score and No. of days in PICU in the Discharged population (N=155)



Patients Shifted to OT (N = 2)

Due to the small sample size, correlation analysis for PRISM III score with glutamine levels and the number of days in the PICU could not be performed in this subgroup.

Table 9: Correlation of PRISM III score between and glutamine and No. of days in PICU in the Diagnosis population (N=172)

Pairs	Pearson Correlation	P-value
Respiratory System (N=45)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.618	<0.001
PRISM III SCORE v No. of days in PICU	0.537	<0.001
Central Nervous System (N=24)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.418	0.042
PRISM III SCORE v No. of days in PICU	0.310	0.140
Infectious (N=24)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.787	<0.001
PRISM III SCORE v No. of days in PICU	0.318	0.130
Hepatic Biliary System (N=19)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.730	<0.001
PRISM III SCORE v No. of days in PICU	0.719	<0.001

Renal System (N=16)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.440	0.088
PRISM III SCORE v No. of days in PICU	0.586	0.017
Gastrointestinal (N=13)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.564	0.045
PRISM III SCORE v No. of days in PICU	0.756	0.003
Cardiovascular System (N=9)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.836	0.005
PRISM III SCORE v No. of days in PICU	0.922	<0.001
Endocrine And Metabolic (N=7)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.436	0.329
PRISM III SCORE v No. of days in PICU	0.461	0.298
Haematological System (N=4)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.667	<0.001
PRISM III SCORE v No. of days in PICU	0.333	0.593
Miscellaneous (N=11)		
PRISM III SCORE vs Glutamine (mmol/L)	-0.722	0.012
PRISM III SCORE v No. of days in PICU	0.896	<0.001

Correlation of PRISM III Score with Glutamine Levels and Length of PICU Stay Based on Diagnosis

Table 9a: Descriptive analysis of glutamine (mmol/l) in different System population

Glutamine (mmol/L)	Mean ± SD	ANOVA(P-value)
Respiratory System	0.45 ± 0.19	<0.001
Central Nervous System	0.35 ± 0.16	
Infectious	0.43 ± 0.17	
Hepatic Biliary System	0.26 ± 0.08	
Renal System	0.49 ± 0.21	
Gastrointestinal System	0.37 ± 0.26	
Cardiovascular System	0.38 ± 0.16	
Endocrine And Metabolic	0.3 ± 0.08	
Haematological System	0.35 ± 0.03	
Miscellaneous	0.65 ± 0.37	
Total	0.41 ± 0.21	

Table 9 Presents the correlation analysis of PRISM III score, glutamine levels (mmol/L), and the number of days in the PICU, stratified by diagnosis in the study population.

Respiratory System (N = 45)

"A moderate negative correlation was observed between PRISM III score and glutamine levels ($r = -0.618$, $p < 0.001$), indicating lower glutamine levels in patients with higher severity scores.

Additionally, a moderate positive correlation was found between PRISM III score and the number of days in the PICU ($r = 0.537$, $p < 0.001$), suggesting prolonged hospitalization in more severe cases."

Figure 20: Scatterplot for correlation between PRISM III score and glutamine in the Respiratory System population (N=45)

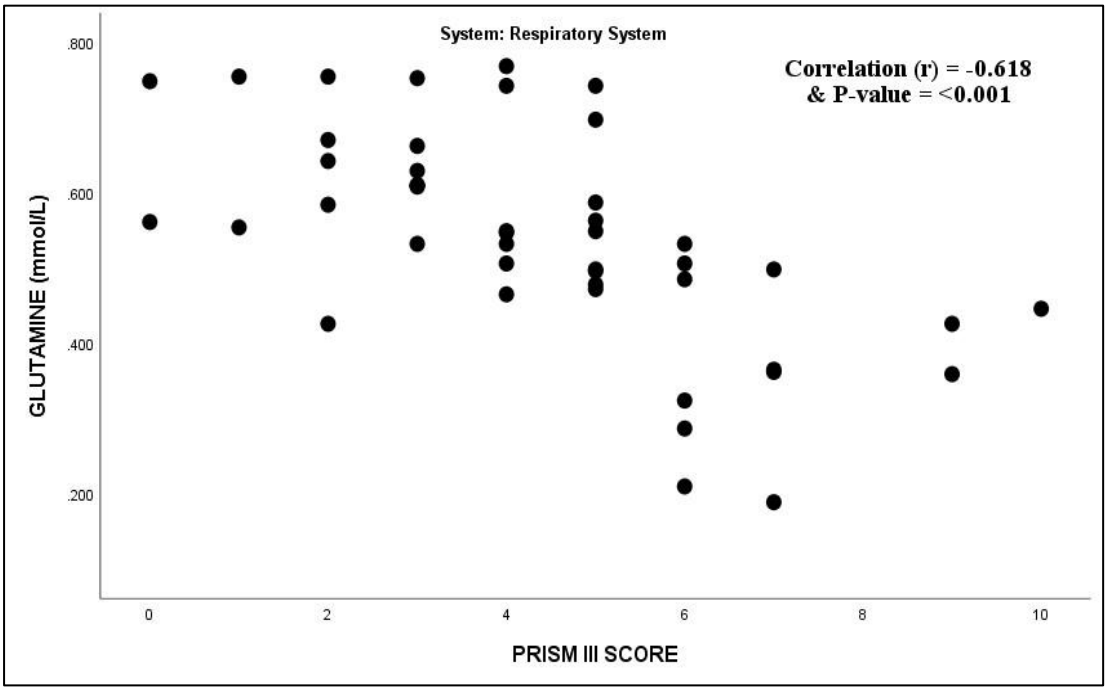
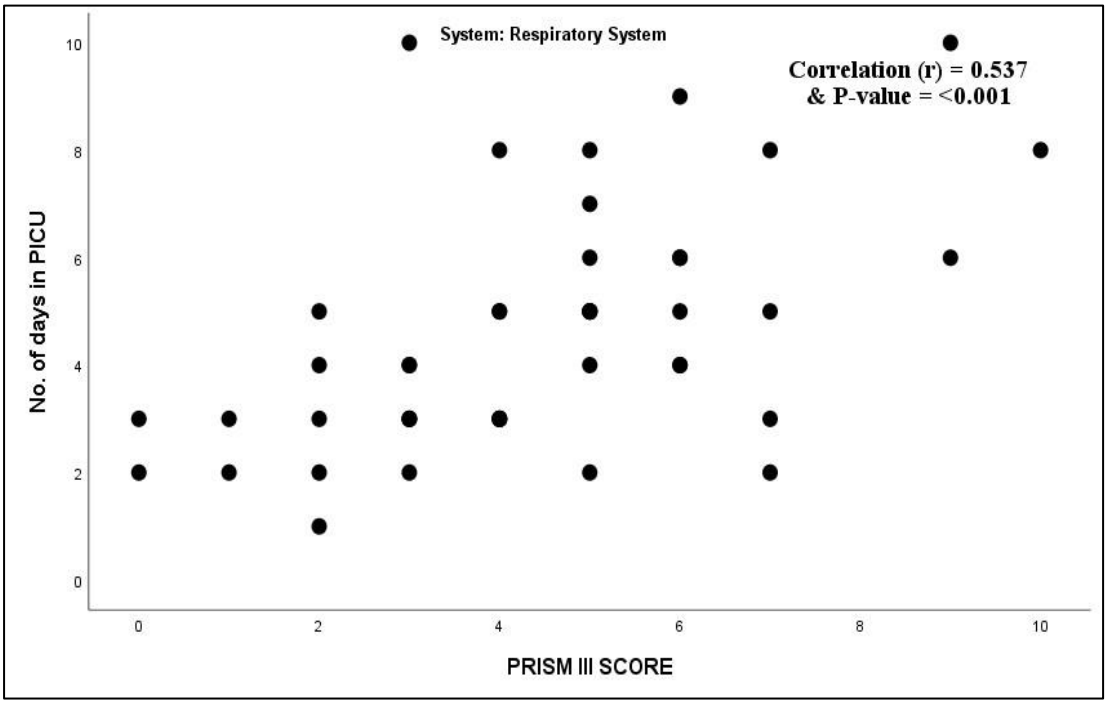


Figure 21: Scatterplot for correlation between PRISM III score and No. of days in PICU in the Respiratory System population (N=45)



Central Nervous System (N = 24)

"A weak negative correlation was noted between PRISM III score and glutamine levels (r = 0.418, p = 0.042), which was statistically significant. However, the correlation between PRISM III score and PICU stay was weak and non-significant (r = 0.310, p = 0.140)."

Figure 22: Scatterplot for correlation between PRISM III score and glutamine in the Central nervous System population (N=24)

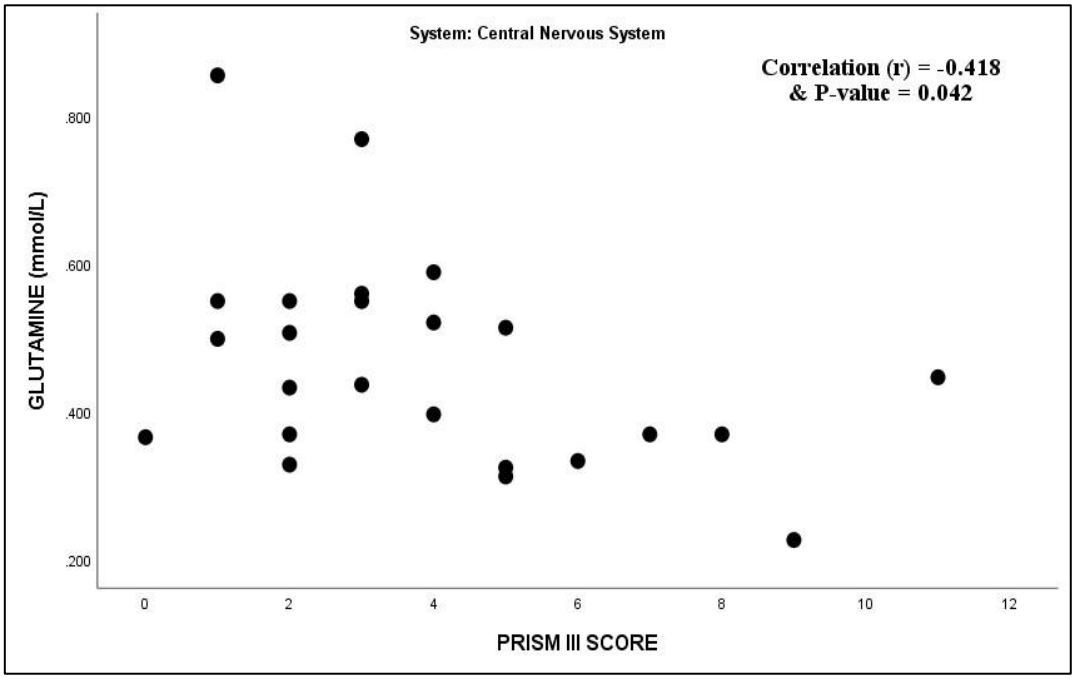
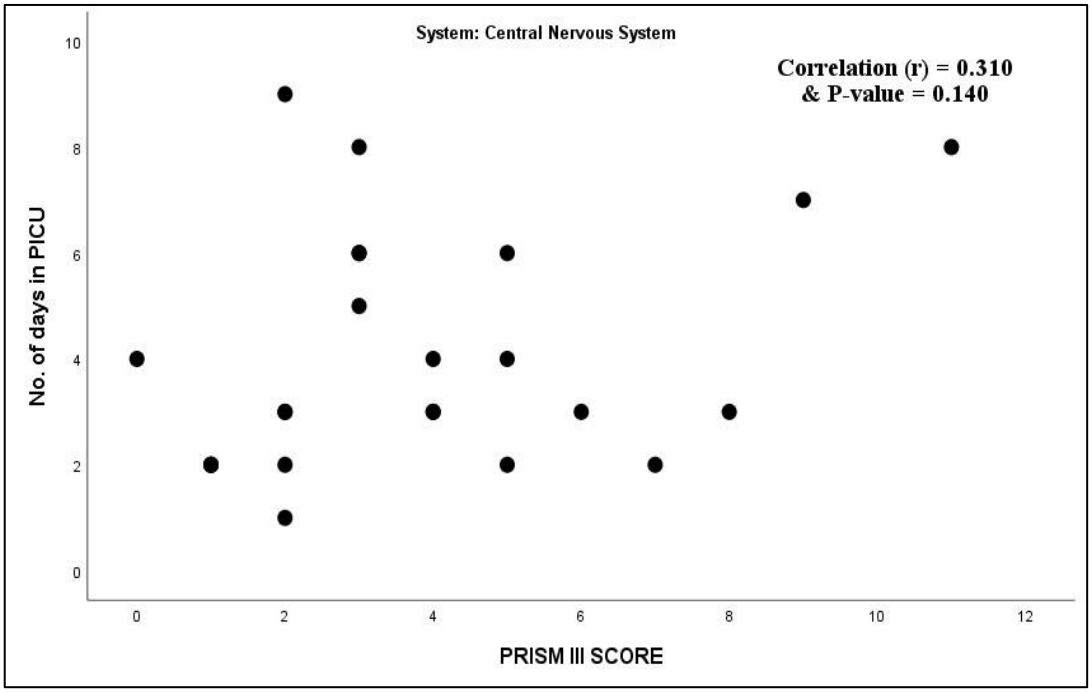


Figure 23: Scatterplot for correlation between PRISM III score and No. of days in PICU in the Central nervous System population (N=24)



Infectious Diseases (N = 24)

"A strong negative correlation was observed between PRISM III score and glutamine levels ($r = -0.787$, $p < 0.001$), showing a significant association between disease severity and lower glutamine levels. However, the correlation between PRISM III score and PICU stay was weak and non-significant ($r = 0.318$, $p = 0.130$)."

Figure 24: Scatterplot for correlation between PRISM III score and glutamine in the A infectious population (N=24)

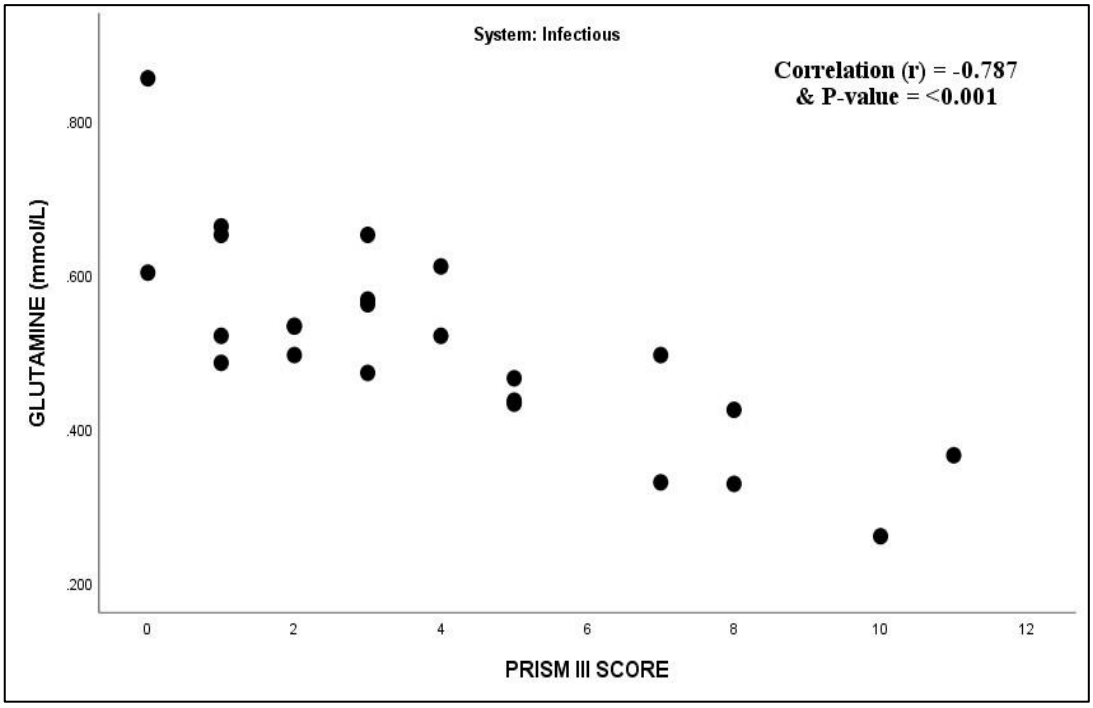
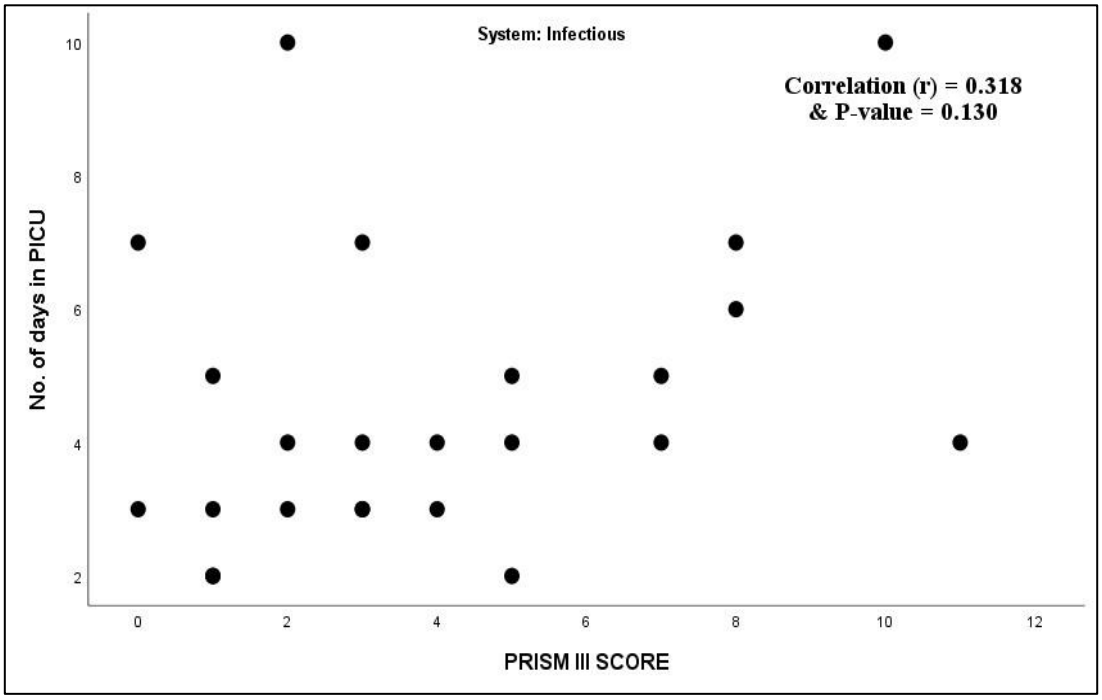


Figure 25: Scatterplot for correlation between PRISM III score and No. of days in PICU in the infectious population (N=24)



Hepatic Biliary System (N = 19)

A strong negative correlation was found between PRISM III score and glutamine levels ($r = 0.730$, $p < 0.001$), while a strong positive correlation was observed between PRISM III score and the number of days in the PICU ($r = 0.719$, $p < 0.001$), indicating that severe cases required longer intensive care.

Figure 26: Scatterplot for correlation between PRISM III score and glutamine in the hepatic biliary system population (N=19)

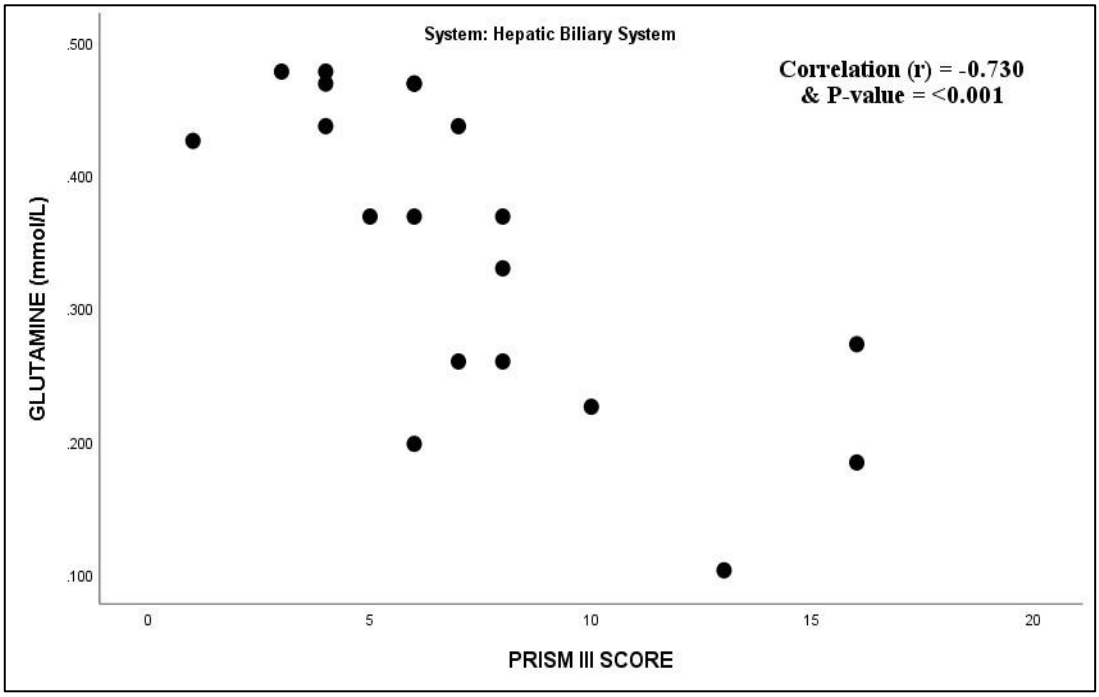
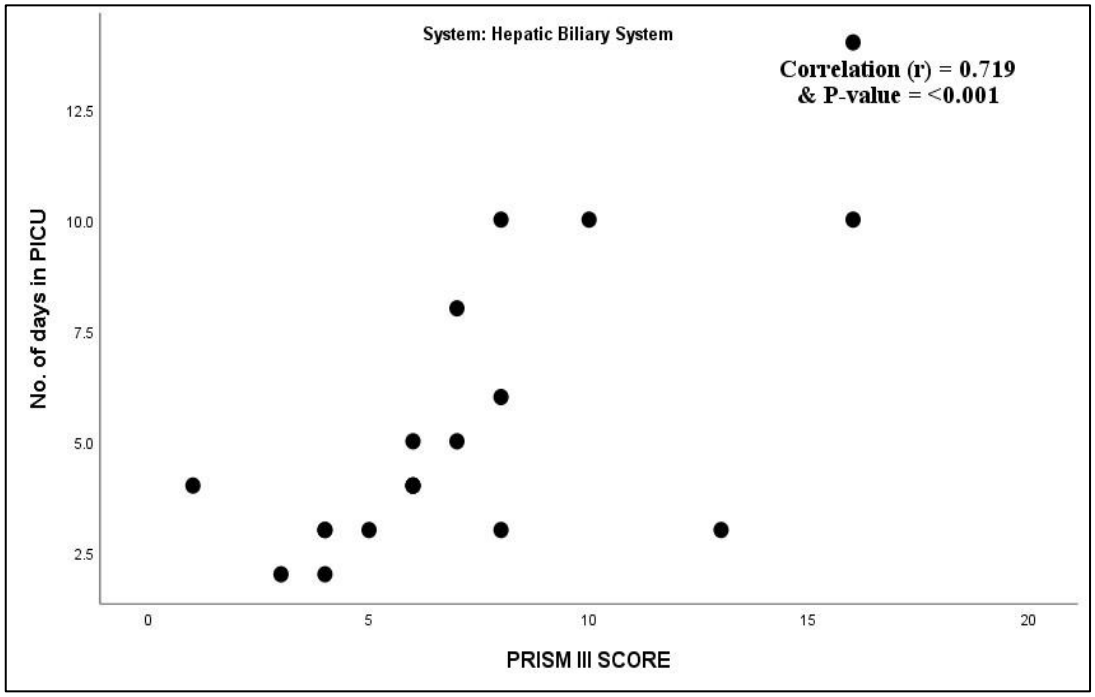


Figure 27: Scatterplot for correlation between PRISM III score and No. of days in PICU in the hepatic biliary system population (N=19)



Renal System (N = 16)

"A moderate negative correlation between PRISM III score and glutamine levels (r = -0.440, p = 0.088) was observed but was not statistically significant. However, a moderate positive correlation between PRISM III score and PICU stay (r = 0.586, p = 0.017) was statistically significant."

Figure 28: Scatterplot for correlation between PRISM III score and glutamine in the Renal System population (N=16)

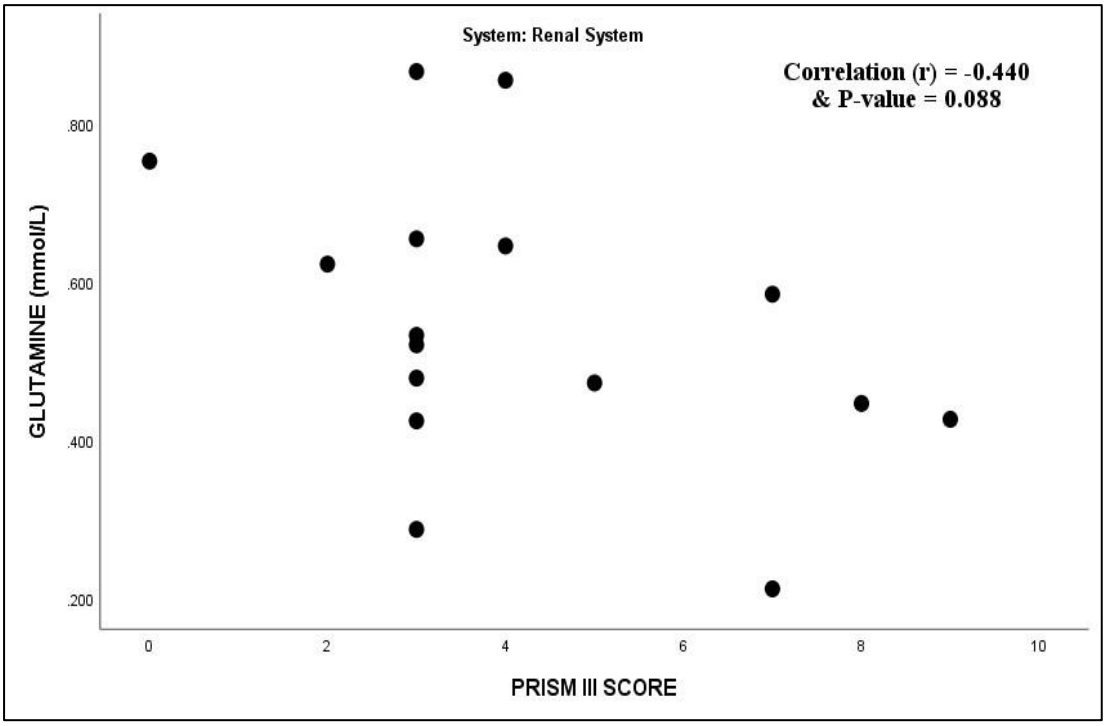
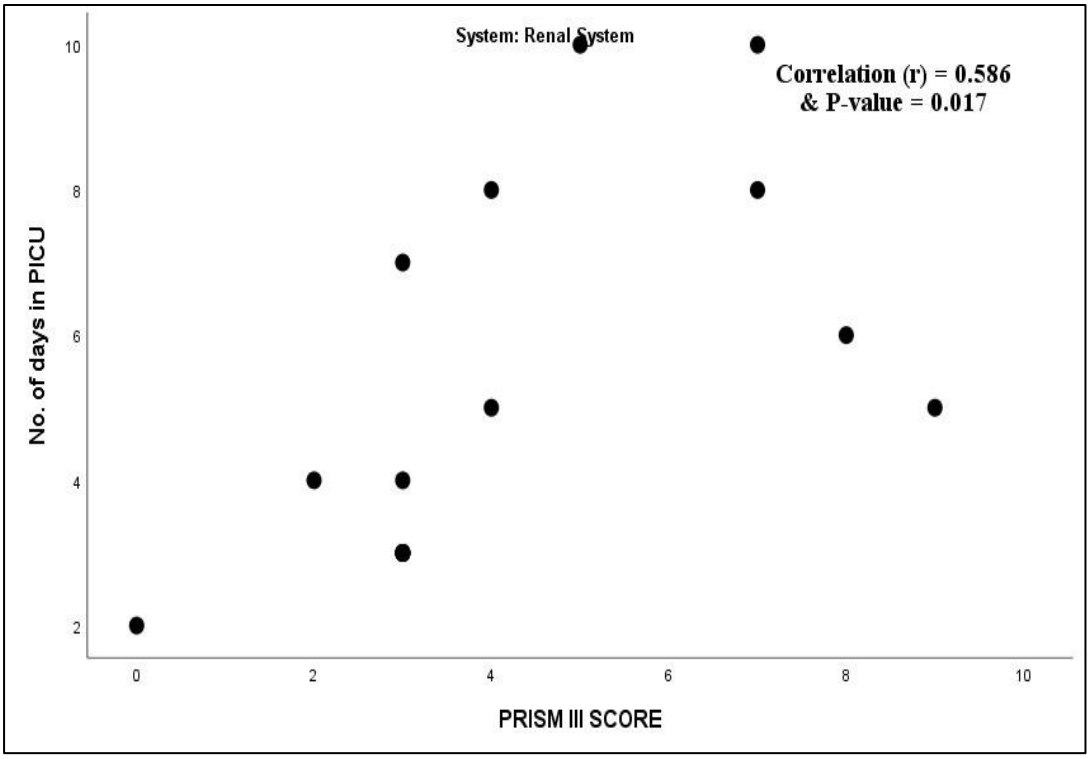


Figure 29: Scatterplot for correlation between PRISM III score and No. of days in PICU in the Renal System population (N=16)



Gastrointestinal System (N = 13)

"A moderate negative correlation was found between PRISM III score and glutamine levels (r = -0.564, p = 0.045), along with a strong positive correlation between PRISM III score and PICU stay (r = 0.756, p = 0.003), suggesting that higher severity scores were associated with both lower glutamine levels and longer ICU stays."

Figure 30: Scatterplot for correlation between PRISM III score and glutamine in the Gastrointestinal System population (N=13)

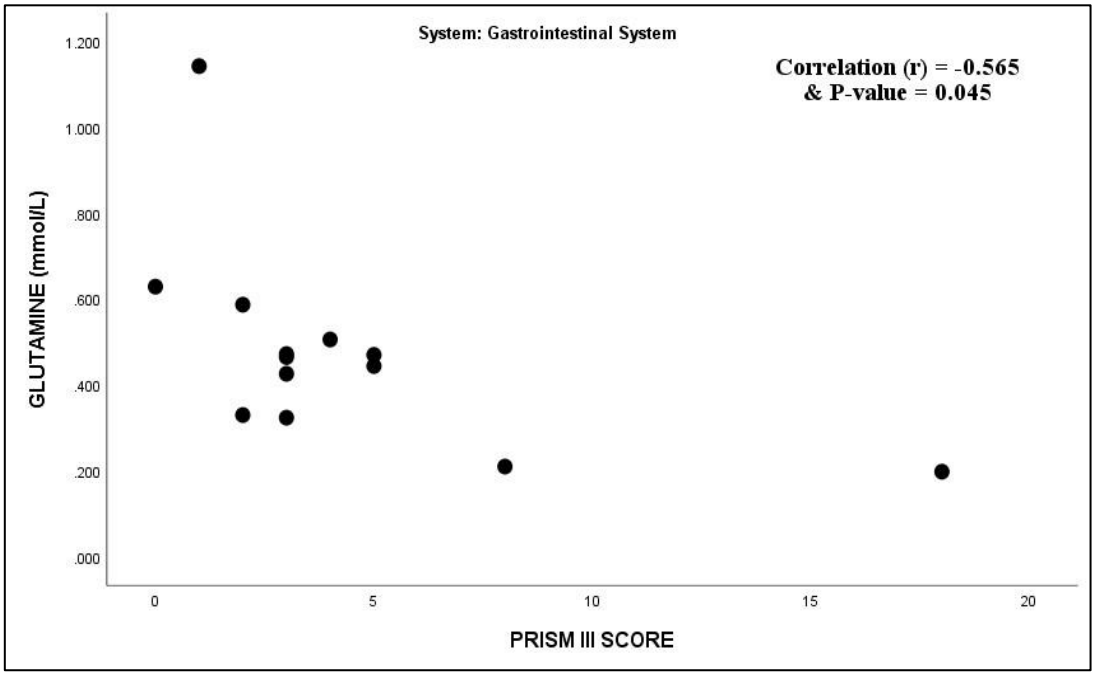
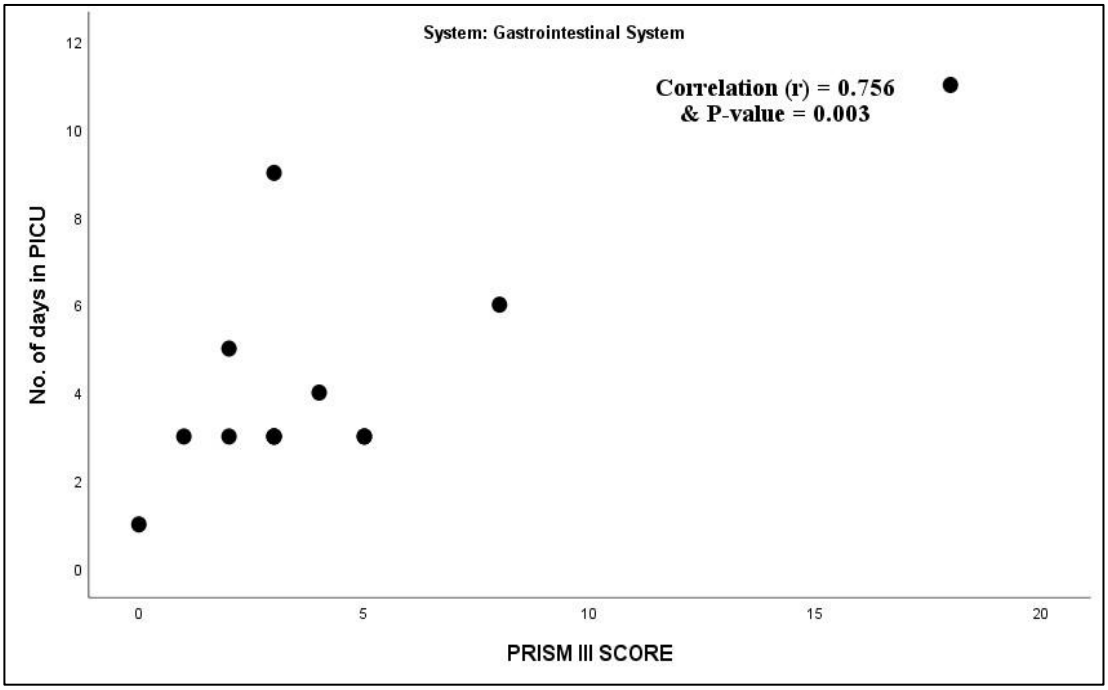


Figure 31: Scatterplot for correlation between PRISM III score and No. of days in PICU in the Gastrointestinal System population (N=13)



Cardiovascular System (N = 9)

"A strong negative correlation was observed between PRISM III score and glutamine levels (r = -0.836, p = 0.005), while a very strong positive correlation was found between PRISM III score and PICU stay (r = 0.922, p < 0.001), indicating a strong relationship between disease severity, reduced glutamine levels, and prolonged hospitalization."

Figure 32: Scatterplot for correlation between PRISM III score and glutamine in the Cardiovascular System population (N=9)

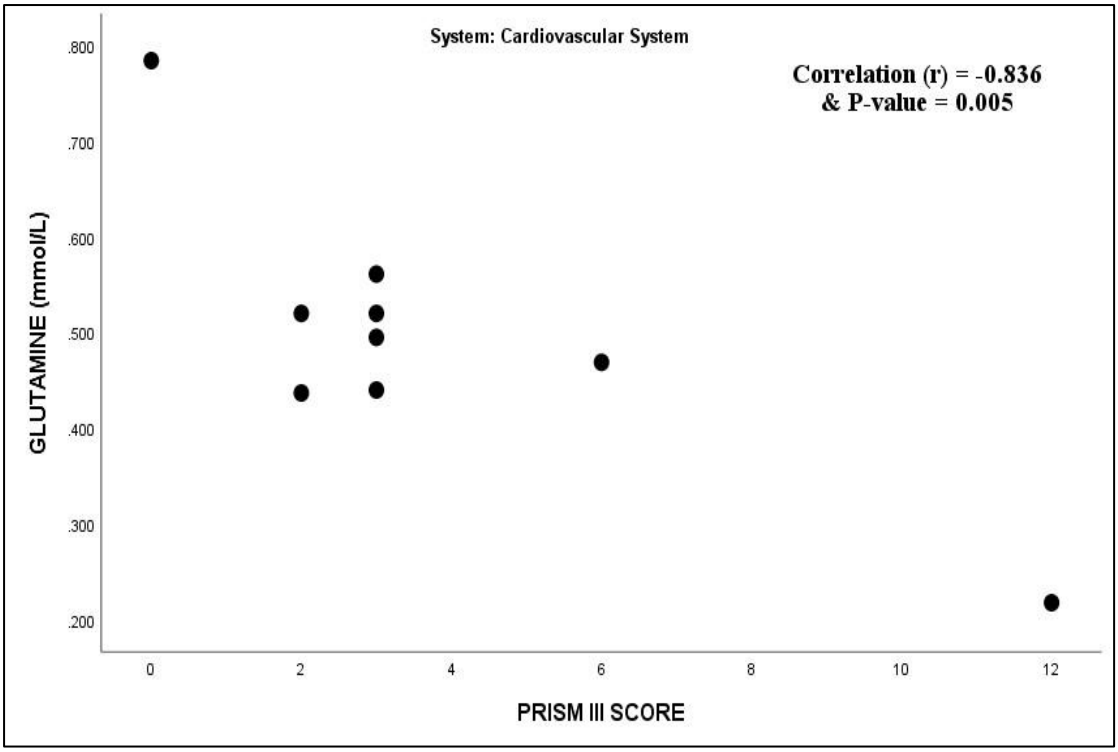
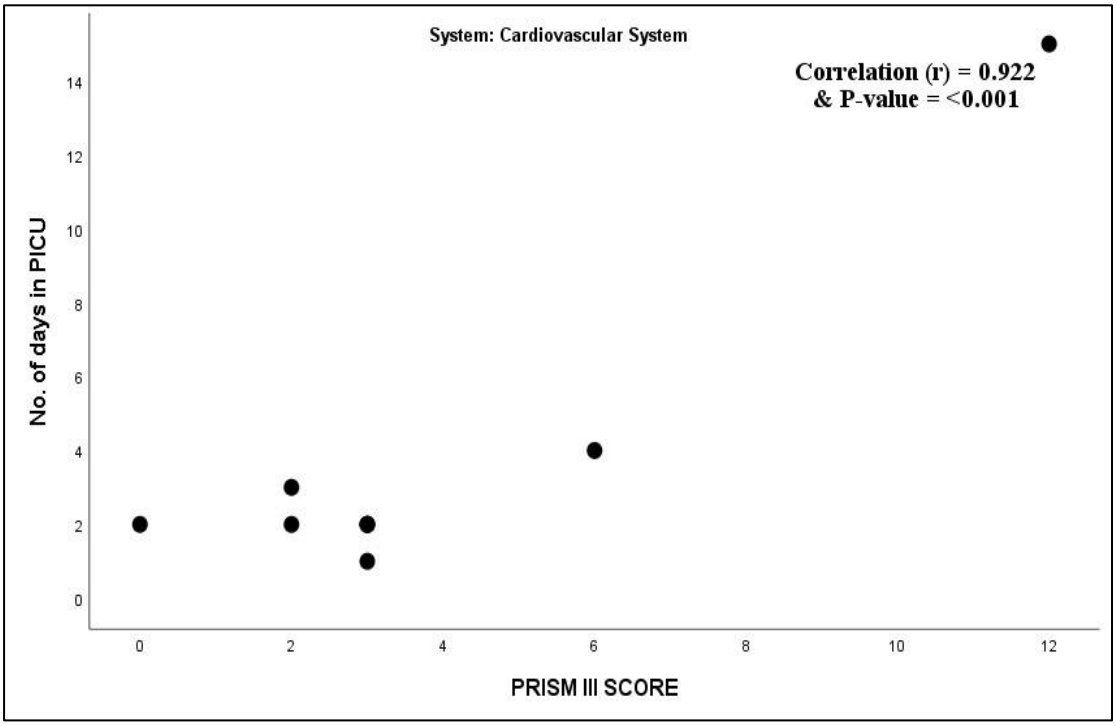


Figure 33: Scatterplot for correlation between PRISM III score and No. of days in PICU in the Cardiovascular System population (N=9)



Endocrine and Metabolic Disorders (N = 7

"A weak negative correlation was found between PRISM III score and glutamine levels (r = 0.436, p = 0.329), along with a weak positive correlation between PRISM III score and PICU stay (r = 0.461, p = 0.298). However, both correlations were not statistically significant."

Figure 34: Scatterplot for correlation between PRISM III score and glutamine in the Endocrine and Metabolic System population (N=7)

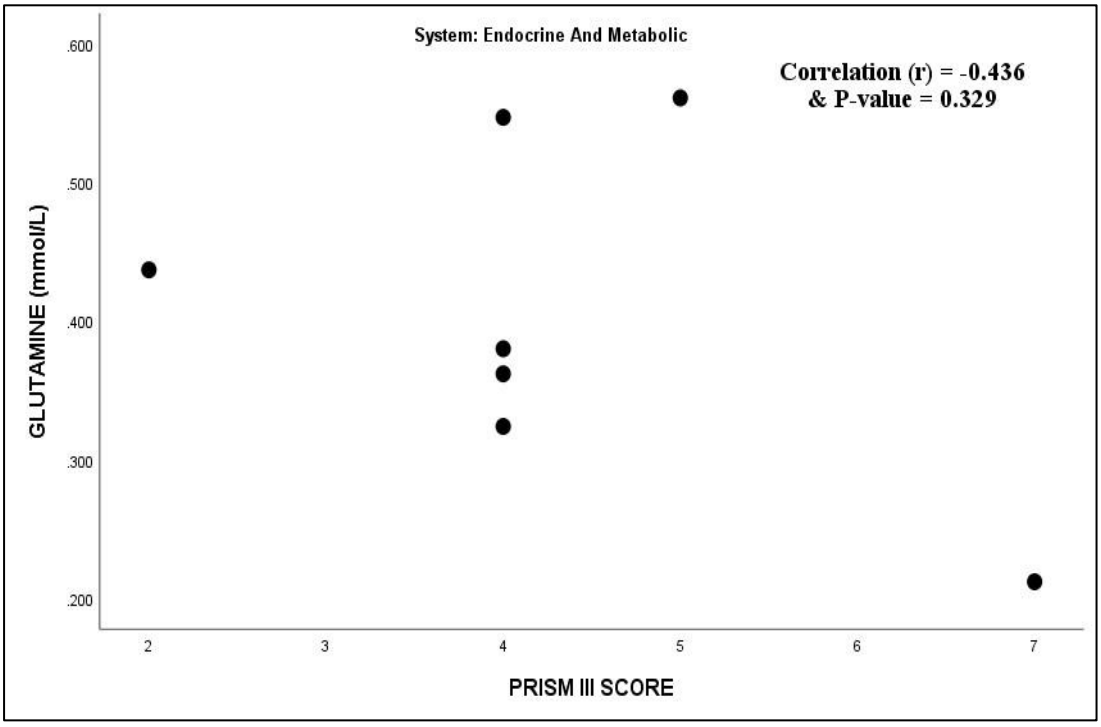
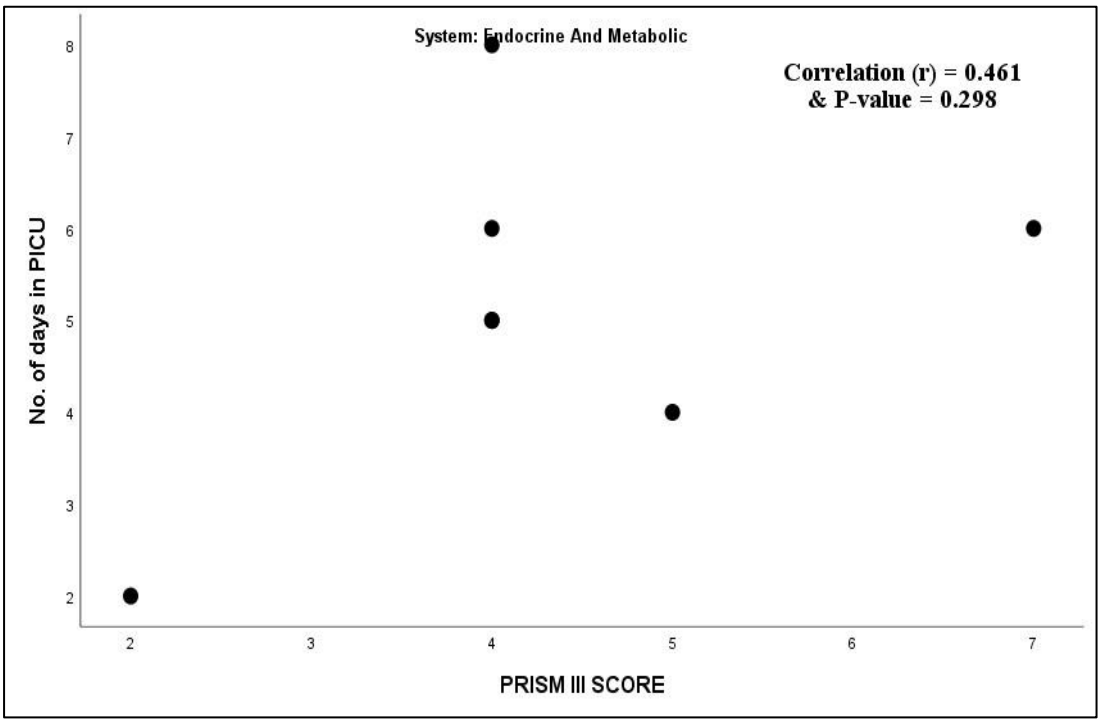


Figure 35: Scatterplot for correlation between PRISM III score and No. of days in PICU in the Endocrine and Metabolic System population (N=7)



Haematological System (N = 4)

"A strong negative correlation between PRISM III score and glutamine levels (r = -0.667, p < 0.001) was observed. However, the correlation between PRISM III score and PICU stay was weak and non-significant (r = 0.333, p = 0.593)."

Figure 36: Scatterplot for correlation between PRISM III score and glutamine in the Haematological System population (N=4)

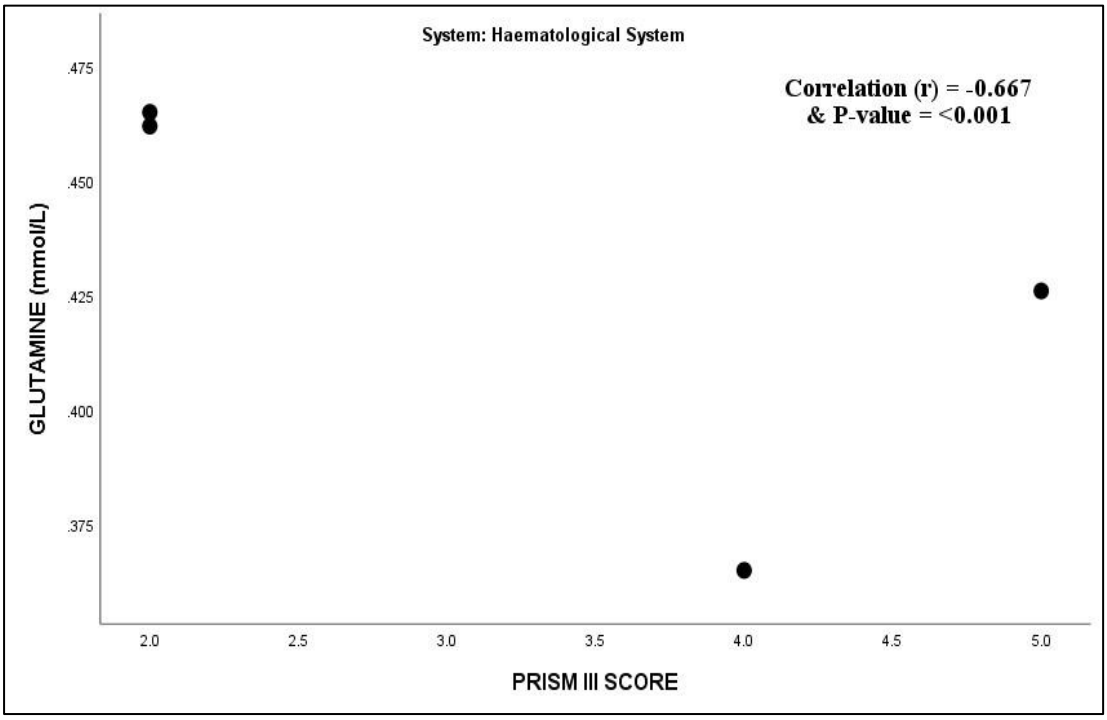
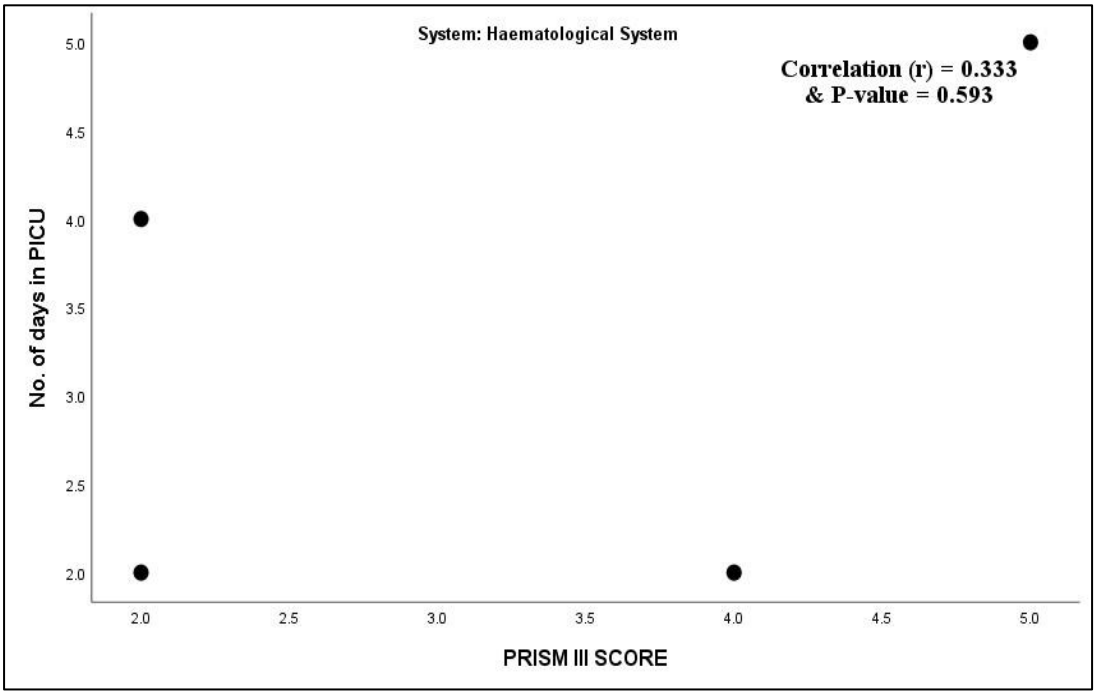


Figure 37: Scatterplot for correlation between PRISM III score and No. of days in PICU in the Haematological System population (N=4)



Miscellaneous Diagnoses (N = 11)

"A strong negative correlation was observed between PRISM III score and glutamine levels ($r = -0.722$, $p = 0.012$), while a very strong positive correlation was found between PRISM III score and PICU stay ($r = 0.896$, $p < 0.001$), suggesting a strong association between disease severity, lower glutamine levels, and longer ICU stays."

Figure 38: Scatterplot for correlation between PRISM III score and glutamine in the Miscellaneous population (N=11)

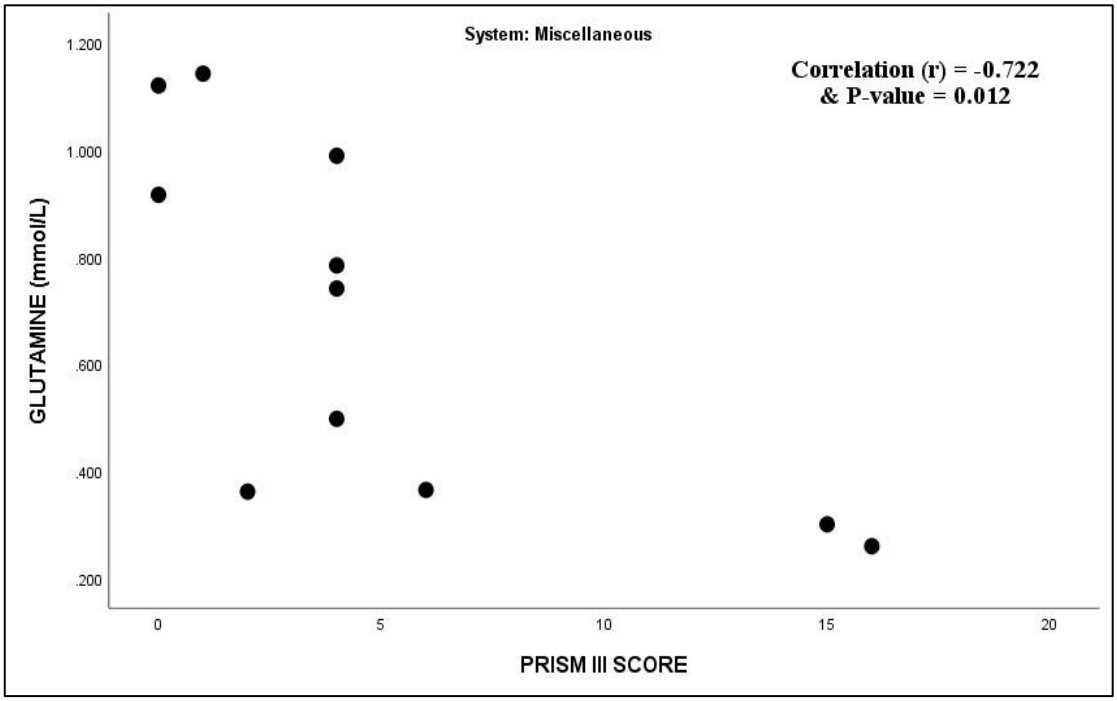


Figure 39: Scatterplot for correlation between PRISM III score and No. of days in PICU in the Miscellaneous population (N=11)

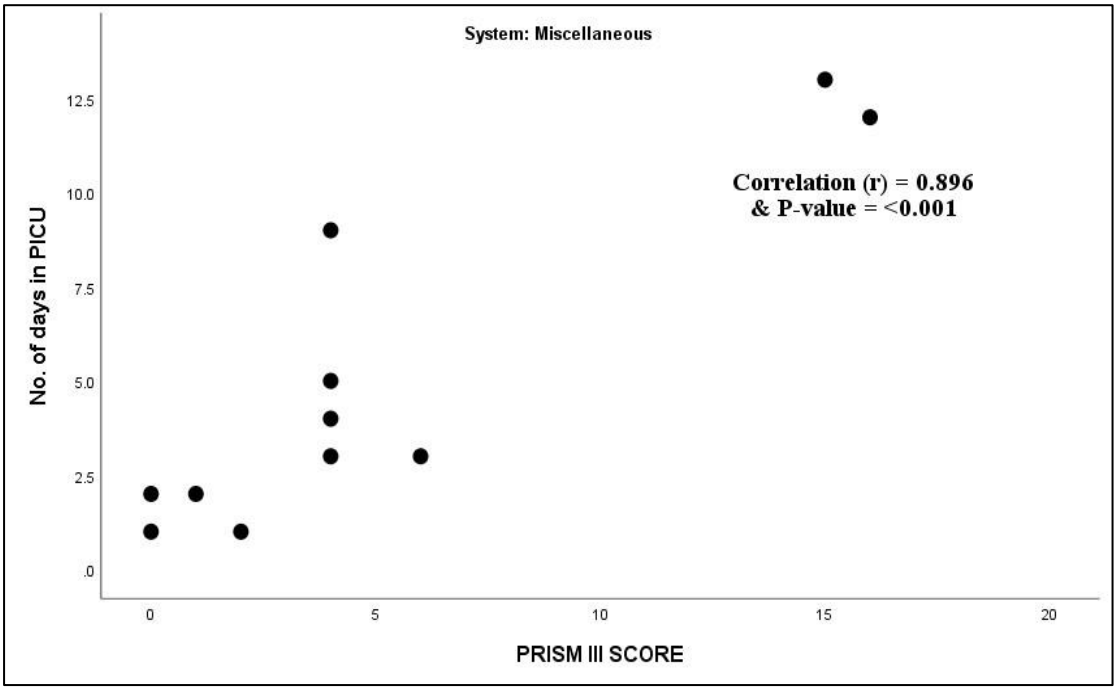


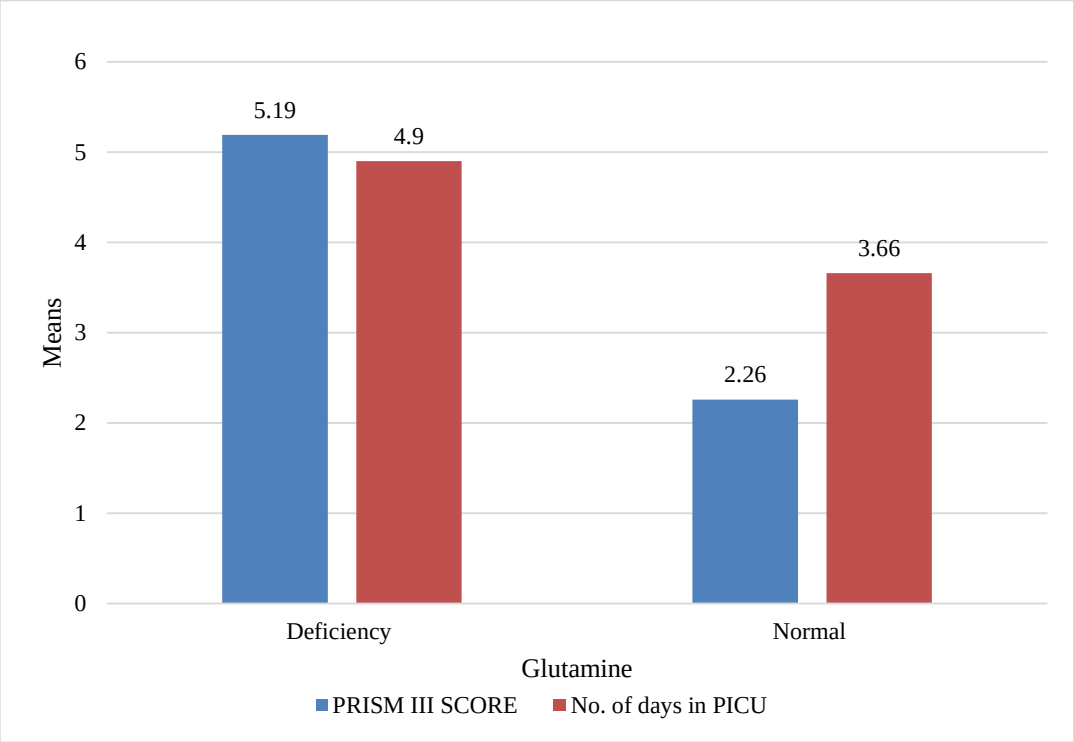
Table 10: Comparison of mean of PRISM III score and No. of days in PICU between glutamine (N=172)

Parameter	Glutamine (Mean± SD)		P value
	Deficiency (N=134)	Normal (N=38)	
PRISM III SCORE	5.19 ± 3.35	2.26 ± 1.61	<0.001
No. of days in PICU	4.9 ± 2.8	3.66 ± 2.2	0.012

Table 10 presents the comparison of PRISM III score and the number of days in the PICU between patients with glutamine deficiency and those with normal glutamine levels in the study population (N = 172).

- Patients with glutamine deficiency (N = 134) had a significantly higher PRISM III score (5.19 ± 3.35) compared to those with normal glutamine levels (N = 38, 2.26 ± 1.61) ($p < 0.001$). This indicates that patients with lower glutamine levels had a higher severity of illness.
- Similarly, the mean number of days in the PICU was significantly higher in patients with glutamine deficiency (4.9 ± 2.8 days) compared to those with normal glutamine levels (3.66 ± 2.2 days) ($p = 0.012$), suggesting that glutamine deficiency may be associated with longer ICU stays.

Figure 40: Clauster bar chart for comparison of mean of PRISM III score and No. of days in PICU between glutamine (N=172)



DISCUSSION

Glutamine deficiency in critically ill children can lead to serious physiological consequences. One of the most significant effects is a weakened immune response, as "glutamine is essential for lymphocyte proliferation, cytokine production, and macrophage function." A lack of glutamine may result in improved susceptibility to infections, prolonged hospital stays, and higher mortality rates. Additionally, glutamine is vital for maintaining intestinal barrier integrity, "preventing bacterial translocation from the gut to the bloodstream." Without adequate glutamine, the intestinal lining becomes more permeable, increasing the risk of sepsis and systemic inflammation. "Muscle wasting is another major concern, as glutamine is necessary for protein synthesis, and its deficiency can lead to loss of lean body mass, delayed recovery, and prolonged mechanical ventilation in critically ill patients. Furthermore, glutamine supports tissue repair and wound healing, and its depletion may contribute to delayed recovery from surgeries, burns, or other injuries."

Managing glutamine deficiency in critically ill children involves ensuring adequate nutrition through enteral or parenteral feeding, incorporating glutamine-rich sources such as whey protein, meat, fish, and dairy. "In some cases, direct glutamine supplementation is considered to enhance immune function, improve gut health, and promote faster recovery. However, while some studies suggest that glutamine supplementation may benefit critically ill patients, its use remains controversial, and individualized patient assessment is crucial. Clinicians must carefully monitor nutritional status, metabolic needs, and the potential risks and benefits of supplementation. Overall, glutamine deficiency in critically ill children poses significant health risks, and addressing it through proper nutritional management may improve clinical outcomes and support faster recovery. Further research is needed to

establish standardized guidelines for glutamine supplementation in paediatric critical care settings. The present study was conducted on children between age group 1 month to 18 years admitted in PICU in KLE DR. Prabhakar kore hospital, Belagavi."

"In the present study, a total of 172 critically ill children, aged between 1 month and 18 years, were systematically evaluated. The mean age of the study participants was determined to be 7.7 ± 5.59 years. To the best of our knowledge, this study represents the first attempt to comprehensively investigate the prevalence of glutamine deficiency in critically ill children within this broad age spectrum. A notable gap was identified in defining distinct age groups, especially neonates and adolescents, within the available literature."

"According to the available database, previous studies have primarily focused on specific paediatric subgroups, such as infants and young children or adolescent populations. A cross-sectional study conducted by **Arunan A, et al.,**[80] involving 428 school-going children enrolled in grades 5 to 10 across government and private high schools in Puducherry. The mean age of their study participants was reported as 14.25 ± 3.52 years.

Similarly, another cross-sectional study conducted by **Kumar N, et al.,**[81] in the Outpatient Department of Paediatrics at the Community Health Centre in Akhnoor, Jammu district over six months period of time examined 239 children diagnosed with protein-energy malnutrition within the age range of 1 to 5 years. The mean age of these participants was reported as 3.62 ± 1.89 years. In contrast another study conducted by **Bhalsod AS, et al.,**[82] assessed 511 adolescent students from three schools in Vadodara city to evaluate various nutritional deficiencies. The mean

age of the adolescents in their study was documented as 15.6 ± 1.81 years. Some other comparable studies are noted in the following Table."

Table 11: **Descriptive analysis of age (years) in study population and comparison with previous studies.**

Sr. No.	Studies	Mean age (years) (Mean ± SD)	No. of cases
1	**The present study**	7.7 ± 5.59	172 (100%)
2	**Arunan A, (2025)[80] et al.,**	14.25 ± 3.52	428 (100%)
3	**Kumar N, (2023)[81] et al.,**	3.62 ± 1.89	139 (100%)
4	**Anusha LK, (2019)[83] et al.,**	3. 82 ± 1.89	128 (100%)
5	**Bhalsod AS, (2019)[82] et al.,**	15.6 ± 1.81	511 (100%)
6	**Murarkar S, (2020)[84] et al.,**	2.38 ± 1.36	3671 (100%)

These findings highlight the existing research gaps concerning the evaluation of glutamine deficiency across the entire paediatric spectrum, which representing the urgent need for further investigations that includes both neonates and adolescents in critically ill populations.

Our investigations revealed that, out of a total of 172 critically ill children, among them 115 (66.86%) were male, while 57 (33.14%) were female. This gender-based distribution demonstrated a higher prevalence of glutamine deficiency among male children as compared to their female participants. In this study, we observed male predominance in glutamine deficiency supported by existing literature, including the research by **Fikawati S, et al.** [85], highlighting glutamine deficiency in children as a significant contributing factor to stunted growth.

Furthermore, several other studies have reported findings similar to the our study, as summarized in the following **Table**.

Table 12: Shows the gender wise comparison with the previous studies.

Sr. No.	Comparative studies	Gender	No. of cases
1	**The present study**	Male	115 (66.86%)
		Female	57 (33.14%)
2	**Arunan A, et al., (2025)[80]**	Male	218 (50.9%)
		Female	210 (49.1%)
3	**Kumar N, (2023)[81] et al.,**	Male	105 (43.93%)
		Female	134 (56.06%)
4	**Murarkar S, (2020)[84] et al.,**	Boys	1939 (52.81%)
		Girls	1732 (47.18%)
5	**Bhalsod AS, et al., (2019)[82]**	Male	258 (50.48%)
		Female	253 (49.51%)

The present analysis revealed that, among the "172 patients evaluated, glutamine deficiency was observed in 134 individuals (77.91%), while 38 patients (22.09%) showed normal glutamine levels. These outcomes consistent with the results of a systematic review performed by **Hsu, CC, et al., [86]** who reported a substantial 72% reduction in glutamine concentrations among critically ill patients. Similarly, **Ekmark, L., et al.,[19]** demonstrated that, 40% of patients admitted to the PICU

revealed, plasma glutamine depletion, which was further associated with an increased risk of developing multiple organ failure. Critical illness is known to exacerbate nutritional deterioration, which significantly impacts patient outcomes. According to **Mehta, N.M., et al.,**[87] nutritional deficiencies are prevalent among critically ill children admitted to PICUs worldwide, leading to poor prognostic outcomes. Several studies have documented that early deterioration of nutritional status is a common phenomenon in this patient population. Notably, nearly onethird of critically ill children experience a decline in their nutritional indices during their PICU stay, regardless of any pre-existing malnourished state, as reported by **Solana, MJ, et al,;**[88] **Bagri, N.K.;**[54] **Briassoulis, G.;**[89] **Lew, C.C.H.;**[90] and **Ventura, JC, et al.**[2] This deterioration can be attributed to a combination of metabolic disturbances and an inability to meet essential nutritional demands, culminating in a progressive macronutrient deficit, as highlighted by **Tume, L.N."**[91]

The presence of nutritional deterioration among severely diseased varies across regions. In Brazilian PICUs, 23% of children demonstrated a worsening of their nutritional status, often linked to the presence of CCCs, as noted by **Ventura, JC, et al.**[2] Furthermore, data from five tertiary care PICUs in Canada indicated that 24.1% of discharged patients developed complications, while 19.5% required hospital readmission.

Alarmingly, the risk of complications and readmission was nearly threefold higher among those classified as being at high nutritional risk or identified as malnourished, as documented by **Létourneau, J, et al.**[92]

- **Descriptive analysis of PRISM III score and glutamine (mmol/l), no. of days in PICU in study population:**

The PRISM III score had a mean of 4.55 ± 3.28, with a median of 4.00 and a range from 0.00 to 18.00. The 95% CI for the mean was 4.05 to 5.04, representing that, the majority of values were within this range. The findings suggested that, the PRISM III scores varied commonly among the patients, indicating differing severity levels of illness. The glutamine levels remained relatively consistent across the cohort, with minimal variability. The length of PICU stay also showed variability, but most patients were discharged within approximately 4 to 5 days. These results provided insight into the clinical characteristics and outcomes of the study population. To the best of our knowledge, there is a lack of documented studies in the existing literature specifically evaluating glutamine levels in critically ill patients. Therefore, our study represents the first to revealed these findings. Thereby, the clinical significance of glutamine in critically ill patients, further research is required to explore its role and potential implications. We recommended that, the future studies focusing on this specific clinical characteristic are essential to enhance the understanding of its impact on patient outcomes and guide evidence-based interventions. PRISM scoring system is widely recognized as one of the most commonly utilized tools for predicting mortality in paediatric intensive care settings. **Nangalu R, et al.,**[93] highlighted that, the predominant use of the PRISM score in clinical practice to assess the severity of illness and estimate the risk of mortality. In a study conducted by **Vermilyea et al.,**[94] the mean PRISM III risk score was reported to be 3.93 in children with normal nutritional status, whereas it was slightly elevated at 4.41 in patients categorized as having moderate to severe malnutrition. However,

this difference did not reach statistical significance (p>0.05), indicating that malnutrition alone may not have had a direct impact on the PRISM III score.

A more recent study conducted by **Mirzayeva et al., (2024)**[95] reported a mean PRISM III score of 5.66 ± 5.20 among paediatric patients. The study population was stratified into three nutritional categories, with 41.3% of children classified as having normal nutritional status, 29.3% as moderately malnourished, and 29.3% as severely malnourished. Despite these variations, no statistically significant correlation was observed between PRISM III scores and patient prognosis (p>0.05), suggesting that, other clinical parameters might play a crucial role in determining outcomes beyond the PRISM score alone.

Moreover, **Nangalu et al.**,[93] emphasized the intrinsic relationship between severe malnutrition and increased mortality risk, even in cases where PRISM III scores were comparable across different nutritional categories. This observation led to their recommendation for an additional scoring parameter tailored to children with weight-forage (WFA) deficits, aiming to enhance the predictive accuracy of mortality risk assessment in this vulnerable population. These findings collectively highlighted that, the complex interplay between malnutrition, critical illness severity, and prognostic indicators, necessitating further refinement of existing scoring models to ensure a more comprehensive evaluation of paediatric patients at risk.

✞ **"Descriptive analysis of outcome in the study population":**

In the present study, the majority of patients demonstrated favorable clinical outcomes, with **90.12% (n=155)** achieving successful discharge following appropriate medical management. A relatively small subset of individuals, comprising **5.81% (n=10),** opted for discharge against medical advice (AMA),

potentially due to personal, financial, or sociocultural factors that warrant further exploration. Unfortunately, despite comprehensive treatment interventions, **2.91% (n=5)** of the patients succumbed to their underlying condition, underscoring the critical need for improved prognostic indicators and therapeutic strategies to enhance survival rates. Additionally, **1.16% (n=2)** of the cases necessitated surgical intervention, requiring immediate transfer to the operating theatre. These findings collectively emphasize the predominantly positive prognosis observed within the study cohort while also highlighting the importance of further research to elucidate the determinants of AMA discharges and mortality.

Further investigations into the role of glutamine supplementation in critically ill populations have yielded variable outcomes. According to **Wang, Y., et al., [96]** VLBW infants receiving parenteral Gln supplementation at a dosage of **0.3 g/kg/day** did exhibit a statistically significant reduction in mortality compared to the control group. However, the study lacked the statistical power necessary to assess rare clinical outcomes, including mortality, or to evaluate multiple endpoints comprehensively.

Similarly, research conducted by **Ekmark, L., et al.,[19] (2014),** in paediatric intensive care units (PICUs), has demonstrated a potential link between reduced plasma glutamine levels and an increased risk of multi-organ failure in critically ill children. This association suggests that glutamine depletion may contribute to heightened mortality rates within this vulnerable population. The findings of **Vinod, N., et al.**,[97] further support this observation, reinforcing the need for targeted nutritional and metabolic interventions in critically ill paediatric patients to mitigate adverse outcomes.

✞ **"Descriptive analysis of diagnosis in the study population":**

In the present study, we noted that glutamine deficiency was associated with various organ dysfunction among them respiratory system emerged as the most frequently affected organ system, with involvement observed in 45 cases (26.16%). This was followed by pathological manifestations in the central nervous system and infectious aetiologies, each reported in 24 participants (13.95%). Hepatobiliary system involvement was identified in 19 cases (11.05%), while renal system pathology was documented in 16 cases (9.30%). The gastrointestinal system was affected in 13 patients (7.56%). Other organ systems, including the cardiovascular system, endocrine and metabolic system, haematological system, and miscellaneous conditions, were noted in 9 (5.23%), 7 (4.07%), 4 (2.33%), and 11 (6.40%) cases, respectively.

Despite these observations, a significant gap found in the literature regarding the prevalence of glutamine deficiency in critically ill paediatric patients aged one month to 18 years. Although, organ system involvement has been well-documented in critically ill children, there remains a paucity of data specifically addressing the role of glutamine depletion in the progression of organ dysfunction and its impact on overall clinical outcomes. Further research is necessary to establish the prevalence, clinical implications, and potential therapeutic benefits of glutamine supplementation in this susceptible patient population.

The findings of the present study align with previous research conducted by **Rodas et al.,[21] Engelen et al.,[98] Watford et al.,[99]** and **Cynober et al.,**[100] which collectively demonstrated that both modest and markedly elevated plasma glutamine levels are associated with organ dysfunction, particularly in cases of renal failure and

acute liver failure. These studies highlight the "complex interplay between glutamine metabolism and organ failure, suggesting that deviations in glutamine levels may serve as both a consequence and a contributing factor to multi-organ dysfunction in critically ill patients. On the other hand, a recent study by **Heyland et al.,**[101] challenged the notion that aggressive protein supplementation yields clinical benefits in critically ill patients. Their findings indicated that, administering higher protein doses compared to standard doses in mechanically ventilated patients did not facilitate earlier discharge. Furthermore, excessive protein consumption was linked to negative outcomes, especially in patients with acute renal injury and those with "elevated organ failure scores". This underscores the need for a nuanced approach to nutritional therapy in critical care settings, emphasizing individualized protein requirements based on organ function and metabolic status."

- **Correlation of PRISM III score between and glutamine and No. of days in PICU in the study population (N=172).**

"Our study shows, the correlation analysis between the PRISM III score and glutamine levels, as well as the duration of stay in the PICU, reveals significant associations. A moderate negative correlation ($r = -0.588$, $p < 0.001$) was observed between the PRISM III score and glutamine levels, suggesting that higher disease severity, as indicated by an elevated PRISM III score, is associated with lower glutamine concentrations. This finding concordance with previous studies that have demonstrated decreased glutamine levels in critically ill paediatric patients, potentially due to increased metabolic demand, impaired synthesis, or catabolic stress responses in severe illness."

"Additionally, a strong positive correlation (r = 0.627, $p < 0.001$) was found between the PRISM III score and the duration of PICU stay. This represents that, patients with higher PRISM III scores tend to have prolonged PICU admissions, consistent with prior research demonstrating that elevated PRISM III scores predict worse clinical outcomes, including prolonged hospitalization and increased morbidity. These findings emphasized, the prognostic utility of the PRISM III score in critically ill paediatric patients and suggest that glutamine levels may serve as a potential biomarker for disease severity and metabolic distress."

- **Correlation of PRISM III score between and glutamine and No. of days in PICU in the Outcome population (N=172):**

The Pearson correlation analysis presented in the table 8, evaluates the association of PRISM III scores with glutamine levels and PICU stay duration among different patient groups.

"In the AMA (Against Medical Advice) group (N=10), a significant negative correlation was observed between the PRISM III score and glutamine levels (r = -0.647, p = 0.043), highlighted that, higher disease severity was associated with lower glutamine levels. Additionally, a strong negative correlation was found between PRISM III scores and the number of days in the PICU (r = -0.772, p = 0.009), suggesting that patients with higher severity scores tended to have shorter PICU stays, possibly due to unfavorable outcomes or premature discharge.

In the Death group (N=5), a negative correlation was observed between PRISM III scores and glutamine levels (r = -0.780), but it was not statistically significant (p = 0.120). Similarly, the correlation between PRISM III scores and PICU stay duration was weak and non-significant (r = -0.329, p = 0.589), implying

that among patients who succumbed, severity scores did not consistently predict PICU duration."

In the Discharged group (N=155), a negative association was observed between PRISM III scores & glutamine level (r = -0.583, p less than 0.001), reinforcing trend that higher disease severity is linked to lower glutamine levels. Conversely, a "strong positive correlation was observed between PRISM III scores and PICU stay duration (r = 0.661, p < 0.001), suggesting that more critically ill patients required prolonged PICU care."

Similar to **Ekmark, L., et al.,**[19] our study reported that "**40%** of patients admitted to the PICU had plasma glutamine depletion, which was linked to the development of multiple organ failure. This suggests that initial glutamine deficiency is a key factor in organ failure among critically ill children."

Similarly, **M. M. Anjali**[102] found, a "male-to-female ratio of 53.30% to 46.70%, with a 10% death rate & 24% severity. The PRISM III score effectively predicted outcomes, with a score of 12 showing a hundred percent sensitivity and ninety-one percent specificity for mortality. A score of seven had a hundred percent sensitivity and ninety -five percent specificity for severre illness, making PRISM III a reliable tool for assessing both mortality and severity in PICU patients." The ROC curve area was 99%, confirming its strong predictive value. As PRISM scores increased, both mortality risk and severity also rose.

Some other prior research has highlighted that glutamine, an essential amino acid for immune function, tends to decrease in critically ill patients, reflecting metabolic stress and poor prognosis. Additionally, the strong positive association between PRISM III scores and PICU length of stay in discharged patients

corroborates earlier findings that, higher severity scores predict prolonged hospitalization due to greater resource utilization and the need for intensive care. However, the lack of significant correlations in the death subgroup contrasts with previous literature, which has often linked higher PRISM III scores with extended PICU stays before mortality.

- **Correlation of PRISM III score between and glutamine and No. of days in PICU in the Diagnosis population (N=172)**

Our study shows an "inverse correlation between PRISM III scores and glutamine levels across most organ systems, with the strongest negative correlation observed in the cardiovascular (-0.836, $p = 0.005$), infectious (-0.787, $p<0.001$), and hepatic biliary (-0.730, $p<0.001$) groups. This suggests that, higher disease severity is associated with lower glutamine levels. Additionally, PRISM III scores showed a significant positive correlation with the duration of PICU stay, particularly in the cardiovascular (0.922, $p<0.001$), gastrointestinal (0.756, $p=0.003$), and hepatic biliary (0.719, $p<0.001$) systems, demonstrating that, greater severity is linked to prolonged hospitalization. These findings consistent with previous studies that, have reported glutamine depletion in critically ill patients due to increased metabolic demand and its association with poor outcomes. Similar correlations between severity scores and prolonged ICU stay have been documented, emphasized that, the prognostic value of PRISM III scores in paediatric critical illness."

Recent study done by **Wunderle C, et al.,**[103] examined organ-related parameters in their study which reveals "notable differences between patients with low and high glutamine levels. Among admission diagnoses, cancer was significantly more prevalent in the low glutamine group (36.5%) compared to the high glutamine

group (21.3%) (p = 0.020). Regarding comorbidities, diabetes mellitus was more frequent in patients with high glutamine levels (26.7%) than in those with low glutamine levels (14.5%) (p = 0.025). However, other organ-related conditions, including chronic kidney disease, coronary heart disease, congestive heart failure, chronic obstructive pulmonary disease, and cerebrovascular disease, did not show statistically significant differences between the groups. These findings suggest a potential association between plasma glutamine levels and specific organ-related conditions, which may have implications for disease progression and metabolic regulation. Further research is warranted to elucidate the underlying mechanisms linking glutamine metabolism to these disease states."

- **Comparison of mean of prism iii score and No. of days in PICU between glutamine(N=172)**

"The present study analysed, the association between glutamine levels and clinical outcomes in paediatric patients admitted to the PICU. The PRISM III score, an established predictor of severity and mortality risk in critically ill paediatric patients, was significantly higher in the glutamine-deficient group (5.19 ± 3.35) compared to the normal glutamine group (2.26 ± 1.61), with a highly significant *P*-value of <0.001." This suggests that, glutamine deficiency is associated with more severe illness, potentially demonstrating a higher inflammatory burden or metabolic stress in these patients.

Furthermore, the "duration of PICU stay was also significantly prolonged in glutamine-deficient patients (4.9 ± 2.8 days) compared to those with normal glutamine levels (3.66 ± 2.2 days), with a *P*-value of 0.012. This finding suggests

that, glutamine deficiency may contribute to prolonged critical illness, delayed recovery, or increased complications during hospitalization."

"Our findings align with previous research highlighting the critical role of glutamine in immune modulation, metabolic homeostasis, and stress response in critically ill patients. Studies have showed that, glutamine depletion is commonly observed in critically ill paediatric and adult patients, with low levels being associated with poor clinical outcomes, including increased morbidity and mortality."

"Supporting to it **Rodas PC, et al.**,[21] reported that, glutamine deficiency in critically ill patients was linked to higher severity scores and prolonged ICU stays. Similar to our study, they found that patients with lower glutamine levels exhibited worse prognostic scores and increased hospital stays, suggesting that glutamine may serve as a biomarker for disease severity."

"Another study done by **Chen QH, et al.,**[59] and **Mok E, et al.,**[104] glutamine supplementation in critically ill paediatric patients was associated with improved outcomes, including reduced length of ICU stay and decreased infection rates. Their findings emphasize the potential role of glutamine in modulating immune function and reducing systemic inflammation, which may contribute to faster recovery."

Moreover, **Nangalu R, et al,;**[93] **Vermilyea et al.,**[94] **and Mirzayeva et al.,**[95] investigated "glutamine levels in critically ill children and found that those with glutamine deficiency had higher PRISM III scores and prolonged ICU stays, consistent with our findings." The prolonged duration of ICU stay in glutamine-deficient patients could be attributed to impaired gut barrier function, increased susceptibility to infections, and reduced overall recovery capacity, as suggested by multiple clinical trials.

While some studies have explored the benefits of glutamine supplementation, findings remain inconclusive, with certain randomized controlled trials (RCTs) showing limited or no significant benefit in mortality reduction. However, given our results, further research into targeted "glutamine supplementation in critically ill paediatric patients with deficiency may be warranted."

Clinical Implications & Future Directive:

Given the association of glutamine deficiency with higher PRISM III scores and prolonged PICU stays, early identification and potential nutritional intervention strategies should be explored. Future studies, particularly randomized controlled trials, are required to assess whether glutamine supplementation in deficient patients can translate into improved clinical outcomes.

CONCLUSION

- The study included 172 participants with a mean age of 7.7 years, ranging from 0.3 to 17 years.
- A significant proportion (77.91%) of sick children had glutamine deficiency, with a mean glutamine level of (0.41 ±0.2) mmol/L.with p value < 0.001
- The mean PRISM III score was 4.55, and the average length of stay in the PICU was 4.63 days.
- Most patients (90.12%) were discharged, while 5.81% left against medical advice, and 2.91% did not survive.
- Correlation analysis showed a negative association between PRISM III scores and glutamine levels.
- Majority of the patients were of respiratory disorders with mean glutamine levels of (0.45 ± 0.19), followed by central nervous system (0.35± 0.16) and infectious diseases (0.43 ± 0.17).
- The severity of low glutamine levels depends on the system affected. In our study, cases involving the hepatobiliary system and burns exhibited significantly low glutamine levels with mean value of (0.26 ± 0.08) and (0.34 ± 0.08) respectively
- Lower glutamine levels were linked to longer PICU stays with p value of 0.012

- Glutamine levels could serve as a potential biomarker for assessing disease severity and prognosis in critically ill children.

- These findings suggested that, as glutamine being immune nutrient plays a vital role in severity of illness and hence this study proving its deficiency in major illness hence warranting the need of glutamine supplementation in sick children.

SUMMARY

Our study showed the presence of glutamine deficiency among severely ill paediatric patients, with 77.91% of the study population exhibiting reduced glutamine levels. A negative link was present between PRISM III scores & glutamine levels, indicating that greater disease severity was associated with lower glutamine concentrations. Additionally, lower glutamine levels were linked to prolonged PICU stays, reinforcing the role of illness severity in determining patient outcomes. The findings suggested that glutamine levels could serve as a "potential biomarker for assessing disease severity and prognosis in critically ill children." Future tests are required to find the therapeutic implications of glutamine addition and its potential benefits in improving clinical outcomes in paediatric intensive care settings.

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ANNEXURE – I - INFORMED CONSENT FORM

"TITLE OF THE PROJECT/STUDY"

PREVELENCE OF GLUTAMINE DEFICIENCY IN CRITICALLY ILL CHILDREN-CROSS SECTIONAL STUDY IN I MONTH TO 18 YEARS OF AGE IN TERTIARY CARE HOSPITAL

Name of Student/Principal Investigator: **(REG NO: BM0122017)**

Name of Guide/Co Investigators:

Introduction: Glutamine is one of the important component in the body which helps in many ways to maintain healthy life. In sick time its levels will be low in the body which leads late recovery of the patient and hence estimation of its levels will be helpful for the study.

Explanation of procedure: After you given the consent, on day 1 admission, glutamine levels will be checked by taking venous sample and PRISM III score will be plotted. Followed by we will correlate with the levels of glutamine with PRISM III score.

Withdrawal from participation in the study: Participation in this study in voluntary. You will be free to decide whether to participate in this study or continue participation once enrolled. In case you decide to withdraw your participation, you are free to do so. However, please convey the decision to the principal investigator.

Possible benefits from participating in the study: you will not get any benefits by participating in this study. The data gathered will help population at large.

Possible risks from participating in the study: There are no risks involved in participating in this study.

Privacy and confidentiality: The information collected from you will be coded, to prevent any person to identify you. Your identity will never be revealed. The data collected from you will be kept confidential and only processed or aggregated data will be used for publication.

Financial incentives: You will not receive any payment for participating in this study. Cost of investigations done during the course of study will be paid by the principal investigator.

Authorization for publication of aggregated data: Results obtained after processing of the aggregated data will be published for scientific purpose and or presented to scientific groups. However, your identity will never be revealed.

Questions: If you have any question or complaints with regard to your right as study participant you may contact Dr Harsha Hegde, Chairperson, Ethical committee of JNMC, 0831-2473777 Extension 4052.

Legal rights: By signing this consent form, we are not waving any of your legal rights

CONSENT STATEMENT

I am making a voluntary decision to participate in the study **"PREVELENCE OF GLUTAMINE DEFICIENCY IN CRITICALLY ILL CHILDREN-CROSS SECTIONAL STUDY IN 1 MONTH TO 18 YEARS OF AGE IN TERTIARY CARE HOSPITAL".** My signature below indicates that I have decided to participate and I have read the information provided above or the information provided above has been read to me in the language that 1 understand best. I was given the opportunity to ask questions and that they have been answered to my satisfaction.

Name of the participant:

Signature or left thumb impression of the participant:

Name of the witness:

Signature or left thumb impression of the witness:

Name of the investigator:

Signature of the investigator:

"TITLE OF THE PROJECT/STUDY"

PREVELENCE OF GLUTAMINE DEFICIENCY IN CRITICALLY ILL CHILDREN-CROSS SECTIONAL STUDY IN I MONTH TO 18 YEARS OF AGE IN TERTIARY CARE HOSPITAL

ಮಾಹಿತಿಯುಕ್ತ ಒಪ್ಪಿಗೆ ನಮೂನೆ

ವಿದ್ಯಾರ್ಥಿ/ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿಯ ಹೆಸರು: **(REG NO: BM0122017)**

ಮಾರ್ಗದರ್ಶಿ/ಸಹ ತನಿಖಾಧಿಕಾರಿಗಳ ಹೆಸರು:

ಪರಿಚಯ: ಗ್ಲುಟಾಮೈನ್ ದೇಹದಲ್ಲಿನ ಪ್ರಮುಖ ಅಂಶಗಳಲ್ಲಿ ಒಂದಾಗಿದೆ, ಇದು ಆರೋಗ್ಯಕರ ಜೀವನವನ್ನು ಕಾಪಾಡಿಕೊಳ್ಳಲು ಹಲವು ರೀತಿಯಲ್ಲಿ ಸಹಾಯ ಮಾಡುತ್ತದೆ. ಅನಾರೋಗ್ಯದ ಸಮಯದಲ್ಲಿ ದೇಹದಲ್ಲಿ ಅದರ ಮಟ್ಟಗಳು ಕಡಿಮೆಯಿರುತ್ತವೆ, ಇದು ರೋಗಿಯು ತಡವಾಗಿ ಚೇತರಿಸಿಕೊಳ್ಳಲು ಕಾರಣವಾಗುತ್ತದೆ ಮತ್ತು ಆದ್ದರಿಂದ ಅದರ ಮಟ್ಟಗಳ ಅಂದಾಜು ಅಧ್ಯಯನಕ್ಕೆ ಸಹಾಯಕವಾಗುತ್ತದೆ.

ಕಾರ್ಯವಿಧಾನದ ವಿವರಣೆ: ನೀವು ಒಪ್ಪಿಗೆ ನೀಡಿದ ನಂತರ, 1 ನೇ ದಿನದಂದು, ನಾಳೀಯ ಮಾದರಿಯನ್ನು ತೆಗೆದುಕೊಳ್ಳುವ ಮೂಲಕ ಗ್ಲುಟಾಮೈನ್ ಮಟ್ಟವನ್ನು ಪರಿಶೀಲಿಸಲಾಗುತ್ತದೆ ಮತ್ತು PRISM III ಸ್ಕೋರ್ ಅನ್ನು ಯೋಜಿಸಲಾಗುತ್ತದೆ. ನಂತರ ನಾವು PRISM III ಸ್ಕೋರ್‌ನೊಂದಿಗೆ ಗ್ಲುಟಾಮೈನ್ ಮಟ್ಟಗಳೊಂದಿಗೆ ಪರಸ್ಪರ ಸಂಬಂಧ ಹೊಂದುತ್ತೇವೆ.

ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವಿಕೆಯಿಂದ ಹಿಂತೆಗೆದುಕೊಳ್ಳುವಿಕೆ: ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಸ್ವಯಂಪ್ರೇರಿತವಾಗಿ ಭಾಗವಹಿಸುವಿಕೆ. ದಾಖಲಾದ ನಂತರ ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಬೇಕೆ ಅಥವಾ ಭಾಗವಹಿಸುವಿಕೆಯನ್ನು ಮುಂದುವರಿಸಬೇಕೆ ಎಂದು ನಿರ್ಧರಿಸಲು ನೀವು ಸ್ವತಂತ್ರರಾಗಿರುತ್ತೀರಿ. ನಿಮ್ಮ ಭಾಗವಹಿಸುವಿಕೆಯನ್ನು ಹಿಂತೆಗೆದುಕೊಳ್ಳಲು ನೀವು ನಿರ್ಧರಿಸಿದರೆ, ನೀವು ಹಾಗೆ ಮಾಡಲು ಸ್ವತಂತ್ರರು. ಆದಾಗ್ಯೂ, ದಯವಿಟ್ಟು ನಿರ್ಧಾರವನ್ನು ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿಗೆ ತಿಳಿಸಿ.

ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದರಿಂದಾಗುವ ಸಂಭಾವ್ಯ ಪ್ರಯೋಜನಗಳು: ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದರಿಂದ ನಿಮಗೆ ಯಾವುದೇ ಪ್ರಯೋಜನಗಳು ಸಿಗುವುದಿಲ್ಲ. ಸಂಗ್ರಹಿಸಿದ ದತ್ತಾಂಶವು ಜನಸಂಖ್ಯೆಗೆ ಸಹಾಯ ಮಾಡುತ್ತದೆ.

ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದರಿಂದ ಸಂಭವನೀಯ ಅಪಾಯಗಳು: ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸುವುದರಿಂದ ಯಾವುದೇ ಅಪಾಯಗಳಿಲ್ಲ.

ಗೌಪ್ಯತೆ ಮತ್ತು ಗೌಪ್ಯತೆ: ನಿಮ್ಮಿಂದ ಸಂಗ್ರಹಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಯಾವುದೇ ವ್ಯಕ್ತಿ ನಿಮ್ಮನ್ನು ಗುರುತಿಸದಂತೆ ತಡೆಯಲು ಕೋಡ್ ಮಾಡಲಾಗುತ್ತದೆ. ನಿಮ್ಮ ಗುರುತನ್ನು ಎಂದಿಗೂ ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ. ನಿಮ್ಮಿಂದ ಸಂಗ್ರಹಿಸಿದ ಡೇಟಾವನ್ನು ಗೌಪ್ಯವಾಗಿಡಲಾಗುತ್ತದೆ ಮತ್ತು ಸಂಸ್ಕರಿಸಿದ ಅಥವಾ ಒಟ್ಟುಗೂಡಿಸಿದ ಡೇಟಾವನ್ನು ಮಾತ್ರ ಪ್ರಕಟಣೆಗೆ ಬಳಸಲಾಗುತ್ತದೆ.

ಆರ್ಥಿಕ ಪ್ರೋತ್ಸಾಹ: ಈ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಿದ್ದಕ್ಕಾಗಿ ನೀವು ಯಾವುದೇ ಪಾವತಿಯನ್ನು ಸ್ವೀಕರಿಸುವುದಿಲ್ಲ. ಅಧ್ಯಯನದ ಸಮಯದಲ್ಲಿ ಮಾಡಿದ ತನಿಖೆಗಳ ವೆಚ್ಚವನ್ನು ಪ್ರಧಾನ ತನಿಖಾಧಿಕಾರಿ ಪಾವತಿಸುತ್ತಾರೆ.

ಒಟ್ಟುಗೂಡಿಸಿದ ದತ್ತಾಂಶದ ಪ್ರಕಟಣೆಗೆ ಅಧಿಕಾರ: ಒಟ್ಟುಗೂಡಿಸಿದ ದತ್ತಾಂಶವನ್ನು ಸಂಸ್ಕರಿಸಿದ ನಂತರ ಪಡೆದ ಫಲಿತಾಂಶಗಳನ್ನು ವೈಜ್ಞಾನಿಕ ಉದ್ದೇಶಕ್ಕಾಗಿ ಪ್ರಕಟಿಸಲಾಗುತ್ತದೆ ಮತ್ತು ಅಥವಾ ವೈಜ್ಞಾನಿಕ ಗುಂಪುಗಳಿಗೆ ಪ್ರಸ್ತುತಪಡಿಸಲಾಗುತ್ತದೆ. ಆದಾಗ್ಯೂ, ನಿಮ್ಮ ಗುರುತನ್ನು ಎಂದಿಗೂ ಬಹಿರಂಗಪಡಿಸಲಾಗುವುದಿಲ್ಲ.

ಪ್ರಶ್ನೆಗಳು: ಈ ಅಧ್ಯಯನಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತೆ ಯಾವುದೇ ಪ್ರಶ್ನೆಗಳಿದ್ದಲ್ಲಿ, ನೀವು ಸಂಪರ್ಕಿಸಲು ಮುಕ್ತರಾಗಿದ್ದೀರಿ: ನೀವು ಡಾ. ಹರ್ಷ ಹೆಗ್ಡೆ, ಅಧ್ಯಕ್ಷರು, ಜೆಎನ್ಎಂಸಿಯ ನೈತಿಕ ಸಮಿತಿ, 0831-2473777 ವಿಸ್ತರಣೆ 4052 ಅನ್ನು ಸಂಪರ್ಕಿಸಬಹುದು.

ಕಾನೂನು ಹಕ್ಕುಗಳು: ಈ ಸಮ್ಮತಿ ನಮೂನೆಗೆ ಸಹಿ ಹಾಕುವ ಮೂಲಕ, ನಾವು ನಿಮ್ಮ ಯಾವುದೇ ಕಾನೂನು ಹಕ್ಕುಗಳನ್ನು ಚಲಾಯಿಸುತ್ತಿಲ್ಲ.

ಸಮ್ಮತಿ ಹೇಳಿಕೆ

"ತೃತೀಯ ಆರೈಕೆ ಆಸ್ಪತ್ರೆಯಲ್ಲಿ 1 ತಿಂಗಳಿನಿಂದ 18 ವರ್ಷ ವಯಸ್ಸಿನವರೆಗಿನ ಗಂಭೀರ ಮಕ್ಕಳ-ಕ್ರಾಸ್ ವಿಭಾಗೀಯ ಅಧ್ಯಯನದಲ್ಲಿ ಗ್ಲುಟಾಮಿನ್ ಕೊರತೆಯ ಸಾಧ್ಯತೆ" ಎಂಬ ಅಧ್ಯಯನದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನಾನು ಸ್ವಯಂಪ್ರೇರಿತ ನಿರ್ಧಾರವನ್ನು ತೆಗೆದುಕೊಳ್ಳುತ್ತಿದ್ದೇನೆ. ಕೆಳಗಿನ ನನ್ನ ಸಹಿಯು ನಾನು ಭಾಗವಹಿಸಲು ನಿರ್ಧರಿಸಿದ್ದೇನೆ ಮತ್ತು ಮೇಲೆ ಒದಗಿಸಲಾದ ಮಾಹಿತಿಯನ್ನು ನಾನು ಓದಿದ್ದೇನೆ ಅಥವಾ ಮೇಲೆ ಒದಗಿಸಲಾದ ಮಾಹಿತಿಯನ್ನು ನನಗೆ ಚೆನ್ನಾಗಿ ಅರ್ಥವಾಗುವ ಭಾಷೆಯಲ್ಲಿ ಓದಲಾಗಿದೆ ಎಂದು ಸೂಚಿಸುತ್ತದೆ. ನನಗೆ ಪ್ರಶ್ನೆಗಳನ್ನು ಕೇಳಲು ಅವಕಾಶ ನೀಡಲಾಯಿತು ಮತ್ತು ಅವುಗಳಿಗೆ ನನ್ನ ತೃಪ್ತಿಗೆ ತಕ್ಕಂತೆ ಉತ್ತರಿಸಲಾಗಿದೆ.

ಭಾಗವಹಿಸುವವರ ಹೆಸರು:
ಭಾಗವಹಿಸುವವರ ಸಹಿ ಅಥವಾ ಎಡ ಹೆಬ್ಬೆರಳಿನ ಗುರುತು:

ಸಾಕ್ಷಿಯ ಹೆಸರು:

ಸಾಕ್ಷಿಯ ಸಹಿ ಅಥವಾ ಎಡ ಹೆಬ್ಬೆರಳಿನ ಗುರುತು:

ತನಿಖೆಯ ಹೆಸರು:

ತನಿಖೆಯ ಹೆಸರು:

ತನಿಖೆಯ ಹೆಸರು:

ತನಿಖೆಯ ಸಹಿ:

ತನಿಖೆಯ ಹೆಸರು:

ತನಿಖೆಯ ಸಹಿ:

"TITLE OF THE PROJECT/STUDY"

PREVELENCE OF GLUTAMINE DEFICIENCY IN CRITICALLY ILL CHILDREN-CROSS SECTIONAL STUDY IN I MONTH TO 18 YEARS OF AGE IN TERTIARY CARE HOSPITAL

सूचित सहमति प्रपत्र

छात्र/प्रधान अन्वेषक का नाम: **(REG NO: BM0122017)**

मार्गदर्शक/सह अन्वेषक का नाम:

परिचय: ग्लूटामाइन शरीर में महत्वपूर्ण घटकों में से एक है जो स्वस्थ जीवन को बनाए रखने में कई तरह से मदद करता है। बीमार होने पर शरीर में इसका स्तर कम होगा जिससे रोगी की रिकवरी देर से होगी और इसलिए इसके स्तर का अनुमान लगाना अध्ययन के लिए मददगार होगा।

प्रक्रिया का विवरण: आपकी सहमति के बाद, प्रवेश के पहले दिन, शिरापरक नमूना लेकर ग्लूटामाइन के स्तर की जाँच की जाएगी और PRISM III स्कोर प्लॉट किया जाएगा। इसके बाद हम PRISM III स्कोर के साथ ग्लूटामाइन के स्तर का सहसंबंध करेंगे।

अध्ययन में भागीदारी से वापसी: इस अध्ययन में भागीदारी स्वैच्छिक है। एक बार नामांकन के बाद आप यह तय करने के लिए स्वतंत्र होंगे कि इस अध्ययन में भाग लेना है या भागीदारी जारी रखना है। यदि आप अपनी भागीदारी वापस लेने का निर्णय लेते हैं, तो आप ऐसा करने के लिए स्वतंत्र हैं। हालाँकि, कृपया निर्णय को मुख्य अन्वेषक को बताएँ।

अध्ययन में भाग लेने से संभावित लाभ: इस अध्ययन में भाग लेने से आपको कोई लाभ नहीं मिलेगा। एकत्र किए गए डेटा से बड़ी आबादी को मदद मिलेगी।

अध्ययन में भाग लेने से संभावित जोखिम: इस अध्ययन में भाग लेने में कोई जोखिम शामिल नहीं है।

गोपनीयता और गोपनीयता: आपसे एकत्रित की गई जानकारी को कोडित किया जाएगा, ताकि कोई भी व्यक्ति आपकी पहचान न कर सके। आपकी पहचान कभी उजागर नहीं की जाएगी। आपसे एकत्रित डेटा को गोपनीय रखा जाएगा और प्रकाशन के लिए केवल संसाधित या एकत्रित डेटा का ही उपयोग किया जाएगा।

वित्तीय प्रोत्साहन: इस अध्ययन में भाग लेने के लिए आपको कोई भुगतान नहीं मिलेगा। अध्ययन के दौरान की गई जांच की लागत का भुगतान मुख्य अन्वेषक द्वारा किया जाएगा।

एकीकृत डेटा के प्रकाशन के लिए प्राधिकरण: एकत्रित डेटा के प्रसंस्करण के बाद प्राप्त परिणाम वैज्ञानिक उद्देश्य के लिए प्रकाशित किए जाएंगे और या वैज्ञानिक समूहों को प्रस्तुत किए जाएंगे। हालाँकि, आपकी पहचान कभी भी उजागर नहीं की जाएगी।

प्रश्न: इस अध्ययन के संबंध में किसी भी प्रश्न के मामले में, आप संपर्क करने के लिए स्वतंत्र हैं: यदि आपके पास अध्ययन प्रतिभागी के रूप में आपके अधिकार के संबंध में कोई प्रश्न या शिकायत है, तो आप डॉ. हर्षा हेगड़े, अध्यक्ष, जेएनएमसी की नैतिक समिति, 0831-2473777 एक्सटेंशन 4052 से संपर्क कर सकते हैं। कानूनी अधिकार: इस सहमति फॉर्म पर हस्ताक्षर करके, हम आपके किसी भी कानूनी अधिकार का त्याग नहीं कर रहे हैं

सहमतिकथन

मैं "गंभीर रूप से बीमार बच्चों में ग्लूटामाइन की कमी की रोकथाम-तृतीयक देखभाल अस्पताल में 1 महीने से 18 वर्ष की आयु में क्रॉस सेक्शनल अध्ययन" अध्ययन में भाग लेने के लिए स्वैच्छिक निर्णय ले रहा हूँ। नीचे मेरा हस्ताक्षर दर्शाता है कि मैंने भाग लेने का फैसला किया है और मैंने ऊपर दी गई जानकारी को पढ़ लिया है या ऊपर दी गई जानकारी मुझे उस भाषा में पढ़कर सुनाई गई है जिसे मैं सबसे अच्छी तरह समझता हूँ। मुझे प्रश्न पूछने का अवसर दिया गया और उनका उत्तर मेरी संतुष्टि के अनुसार दिया गया।

प्रतिभागी का नाम:

प्रतिभागी के हस्ताक्षर या बाएँ अंगूठे का निशान:

गवाह का नाम:

गवाह के हस्ताक्षर या बाएँ अंगूठे का निशान:

अन्वेषक का नाम:

अन्वेषक के हस्ताक्षर:

"TITLE OF THE PROJECT/STUDY"

PREVELENCE OF GLUTAMINE DEFICIENCY IN CRITICALLY ILL CHILDREN-CROSS SECTIONAL STUDY IN I MONTH TO 18 YEARS OF AGE IN TERTIARY CARE HOSPITAL

माहितीपूर्ण संमती फॉर्म

वद्यिार्थी/मुख्याध्यापक अन्वेषकांचे नाव: **(REG NO: BM0122017)**

मार्गदर्शक/सह-संशोधकांचे नाव:

परचिय: ग्लूटामाइन हा शरीरातील एक महत्त्वाचा घटक आहे जो नरिोगी जीवन राखण्यासाठी अनेक प्रकारे मदत करतो. आजारी असताना शरीरात त्याचे प्रमाण कमी असते ज्यामुळे रुग्ण उशरिा बरा होतो आणम्हिणूनच त्याच्या पातळीचा अंदाज घेणे अभ्यासासाठी उपयुक्त ठरेल.

प्रक्रयिचे स्पष्टीकरण: तुम्ही संमती दल्यिानंतर, पहल्या दविशी प्रवेश घेताना, शरिासंबंधी नमुना घेऊन ग्लूटामाइनची पातळी तपासली जाईल आणPRISM III स्कोअर प्लॉट केला जाईल. त्यानंतर आम्ही PRISM III स्कोअरसह ग्लूटामाइनच्या पातळीशी सहसंबंधति करू.

अभ्यासातून माघार: या अभ्यासात सहभाग ऐच्छकि आहे. नोंदणी झाल्यानंतर या अभ्यासात सहभागी व्हायचे की सहभाग सुरू ठेवायचा हे तुम्ही ठरवू शकता. जर तुम्ही तुमचा सहभाग मागे घेण्याचा नर्णिय घेतला तर तुम्ही ते करू शकता. तथापि, कृपया नर्णिय मुख्य अन्वेषकांना कळवा.

अभ्यासात सहभागी होण्याचे संभाव्य फायदे: या अभ्यासात सहभागी होऊन तुम्हाला कोणतेही फायदे मळिणार नाहीत. गोळा केलेला डेटा मोठ्या प्रमाणात लोकसंख्येला मदत करेल.

अभ्यासात सहभागी होण्याचे संभाव्य धोके: या अभ्यासात सहभागी होण्यात कोणतेही धोके नाहीत.

गोपनीयता आणि गोपनीयता: तुमच्याकडून गोळा केलेली माहिती कोडेड केली जाईल, जेणेकरून कोणीही तुमची ओळख पटवू शकणार नाही. तुमची ओळख कधीही उघड केली जाणार नाही. तुमच्याकडून गोळा केलेला डेटा गोपनीय ठेवला जाईल आणि केवळ प्रक्रिया केलेला कवि एकत्रित डेटा प्रकाशनासाठी वापरला जाईल.

आर्थिक प्रोत्साहन: या अभ्यासात सहभागी होण्यासाठी तुम्हाला कोणतेही पैसे मिळिणार नाहीत. अभ्यासादरम्यान केलेल्या तपासाचा खर्च मुख्य तपासनीस देईल.

एकत्रित डेटा प्रकाशित करण्यासाठी अधिकृतता: एकत्रित डेटा प्रक्रिया केल्यानंतर मिळालेले निकाल वैज्ञानिक उद्देशाने प्रकाशित केले जातील कवि वैज्ञानिक गटांना सादर केले जातील. तथापि, तुमची ओळख कधीही उघड केली जाणार नाही.

प्रश्न: या अभ्यासासंदर्भात कोणतेही प्रश्न असल्यास, तुम्ही संपर्क साधू शकता: जर तुम्हाला अभ्यास सहभागी म्हणून तुमच्या अधिकाराबाबत काही प्रश्न कवि तक्रारी असतील तर तुम्ही डॉ. हर्षा हेगडे, अध्यक्षा, जेएनएमसीच्या नैतिक समिती, ०८३१-२४७३७७७ एक्सटेंशन ४०५२ यांच्याशी संपर्क साधू शकता.

कायदेशीर हक्क: या संमती फॉर्मवर स्वाक्षरी करून, आम्ही तुमचे कोणतेही कायदेशीर अधिकार सोडत नाही आहोत.

संमती वधिान

मी "त्रदियार्थी काळजी रुग्णालयात १ महनिा ते १८ वर्षे वयोगटातील गंभीर आजारी मुलांमध्ये ग्लूटामाइनच्या कमतरतेची शक्यता" या अभ्यासात सहभागी होण्याचा स्वेच्छेने नर्णिय घेत आहे. खाली दलिेल्या माझ्या स्वाक्षरीवरून असे दसिून येते की मी सहभागी होण्याचा नर्णिय घेतला आहे आणि मी वर दलिेली माहतिी वाचली आहे कविा वर दलिेली माहतिी मला ज्या भाषेत सर्वात चांगली समजते त्या भाषेत वाचून दाखवण्यात आली आहे. मला प्रश्न वचिारण्याची संधी देण्यात आली आणि त्यांची उत्तरे माझ्या समाधानानुसार देण्यात आली आहेत.

सहभागीचे नाव:

सहभागीची स्वाक्षरी कविा डाव्या अंगठ्याचा ठसा:

साक्षीदाराचे नाव:

साक्षीदाराची स्वाक्षरी कविा डाव्या अंगठ्याचा ठसा:

तपासकर्त्याचे नाव:

तपासकर्त्याची स्वाक्षरी:

ANNEXURE II - PROFORMA

1) IP NO-

2) DATE-

3) SERAL NO-

SOCIO-DEMOGRAPHIC DETAILS

INFORMANT-

1)NAME-

2) RELATION-

3) PROFESSION-

4) EDUCATION-

5) ADDRESS-

6) TELEPHONE-

PATIENT-

1) NAME-
2) AGE-
3) SEX-
4) DOA-
5) WEIGHT-
6) **Initial impression-**

Consciousness- Alert/irritable/unresponsive/unconscious

Breathing- increased WOB/ decreased WOB/absent efforts/abnormal sounds

(WOB- work of breathing)

Colour- pallor/mottling/cyanosis

7) **Primary assesement-**

Airway-clear/maintainable/non maintainable

Breathing-

Respiratory rate-

Respiratory efforts- nasal flaring/retractions/head bobbing

Chest expansions and distal movements

Lung and airway sounds- crackles/stridor/wheeze/grunt

Spo2-

Circulation-

Heart rate- Rhythm-

Pulses-

i) peripheral- ii) central-

CFT- BP-

Skin color-

Disability- level of conscious by AVPU scale

Pupil- PERRLA

Exposure- trauma/bleeding/burns

8) **Secondary assessment-**

Focused history- Signs and symptoms

Allergy

Medications

Past medical history

Last meal

Events leading to current illness

Focused examination-

Head to toe examination-

Central nervous system-

Per abdomen-

Cardiovascular system-

Investigations- Glutamine levels on day 1-

PRISM III SCORE

PARAMETER	ON ADMISSION	SCORE
Systolic BP		
Diastolic BP		
Heart rate		
Respiratory rate		
Pao2/Fio2		
Paco2		
GCS		
Pupillary reaction		
PT/APTT		
Total bilirubin		
Potassium		
Calcium		
Glucose		
Bicarbonate		

AVPV SCALE-

A- The patient is Awake

V-The patient responds to verbal stimulation

P-The patient responds to painful stimulation

V-The patient is completely unresponsive

PERLLA- Pupils Equal Round Reactive to Light and Accomodation

Diagnosis-

Treatment given-

Final outcome-

PICU stay-

Table 1: PRISM III score

Variables	Age restrictions and Range		Score
Systolic blood pressure in mm Hg	Infants 130-160 55-65 >160 40-54 < 40	Children 50-200 65-75 >200 50-64 <50	 2 6 7
Diastolic blood pressure in mm Hg	All ages >110		6
Heart rate in beats per minute	Infants > 160 <90	Children > 150 < 80	 4 4
Respiratory rate in breaths per minute	Infants 61-90 >90 apnea	Children 51-70 > 70 apnea	 1 5 5
PaO2/FiO2	All ages	200-300 <200	2 3
PaCO2 in torr (mm Hg)	All ages	51-65 >65	1 5
Glasgow coma score	All ages	<8	6
Pupillary reactions	All ages	Unequal or dilated Fixed and dilated	4 10
PT/PTT	All ages	1.5 times control	2
Total bilirubin mg/dL	>1 month	> 3.5	6
Potassium in mEq/L	All ages	3.0-3.5 6.5-7.5 < 3.0 > 7.5	1 1 5 5
Calcium in mg/dL	All ages	7.0-8.0 12.0-15.0 <7.0 >15.0	2 2 6 6
Glucose in mg/dL	all ages	40-60 250-400 <40 >400	4 4 8 8
Bicarbonate in mEq/L	all ages	<16 >32	3 3

ANNEXURE III – MASTER CHART

SL. NO	IP NUMBER	PATIENT NAME	AGE/SEX	DIAGNOSIS	PRISM III SCORE	GLUTAMINE (mmol/L)	No. of days in PICU	OUTCOME
1	10005290	Moher	5months/female	Bronchopneumonia	7	0.362	3	Discharged
2	10005625	sakshi	18 months/female	Bronchopneumonia	0	0.361	3	Discharged
3	10006634	Mulwab	2year/male	AGE with some dehydration	3	0.26	3	Discharged
4	10007215	Bibiayesha	4 year/male	Dengue fever	7	0.315	4	Discharged
5	10005634	amrutha	11 year/female	Chronic pancreatitis	2	0.16	5	Discharged
6	10007886	mohez	17 year/male	Snake bite	4	**0.784**	**5**	Discharged
7	10007874	Tarun	6 year/male	Type 1 DM with DKA	7	0.212	6	Discharged
8	10008984	Malik	14 year/male	Snake bite	0	**1.12**	**2**	Discharged
9	10009199	Afreen	8 year/male	Dengue fever	5	0.26	2	Discharged
10	10010057	Prajwal	15 year/male	Hepatitis A with encephalopathy	13	0.103	3	**DEATH**
11	10010112	Saluddin	11 months/female	LRTI with DKA	7	0.19	8	Discharged
12	10009428	Naveen	11 year/male	SRNS with PSGS	3	**0.654**	**4**	Discharged
13	10010861	Samarth	3 year/male	Hepatitis A with encephalopathy	16	0.184	10	Discharged
14	10010865	Harsha	15 year/male	Chronic pancreatitis	3	0.222	9	Discharged
15	10012727	Krish	6 year/male	Atypical HUS	7	0.404	10	Discharged
16	10015898	Lakkanna	8year/male	Acute hepatitis with encephalopathy	10	0.164	10	Discharged
17	10020239	Laxmi	4year/female	Bronchopneumonia	4	0.29	3	**AMA**
18	10020243	Manvitha	6year/female	Bronchopneumonia with cerebral palsy	5	0.318	5	Discharged
19	10021081	Hanumanth	10 year/male	Type 1 DM	4	0.16	5	Discharged
20	10021312	Prashant	10months/male	Wilson disease	6	0.144	4	**AMA**
21	10025068	Ruthvi	18 months/female	Meningoencephalopathy	2	0.15	9	Discharged

22	10025579	Durgappa	6 years/male	Viral enecephalitis	5	**0.144**	**6**	Discharged
23	10025575	Soujanya	3years/female	Bronchopneumonia	3	**0.61**	**3**	Discharged
24	10027589	Gowri	13 years/female	Hepatitis A	5	0.19	3	Discharged
25	10027622	arushi	3years/female	Bronchopneumonia	4	0.38	5	Discharged
26	10030020	danesh	8year/male	Bronchopneumonia	3	**0.64**	4	Discharged
27	10031654	Sanvi	10 year/female	Wilson disease	4	0.31	2	**DEATH**
28	10031756	B/O Reshma	2 year/male	Bronchopneumonia	5	0.41	5	Discharged
29	10031919	Aarush	2 year/male	Spastic CP	1	**0.854**	**2**	Discharged
30	10032405	Anam	6 years/male	Bronchopneumonia with pleural effusion	6	0.324	5	Discharged
31	10032444	Thrupti	17years/female	SLE with lupus nephritis	4	**0.989**	4	Discharged
32	10032715	Pratiksha	7 years/female	GBS	3	0.39	8	Discharged
33	10033813	Md Ali	14 year/male	SLE	4	**0.741**	**9**	**DEATH**
34	10033832	Ananya	2 year/female	Bronchopneumonia	5	0.383	8	Discharged
35	10033911	Komala	13year/male	CKD	4	**0.645**	**5**	Discharged
36	10033850	Praveen	8year/male	LRTI	5	**0.742**	**2**	Discharged
37	10035601	Purvi pradeep	14years/female	Severe bronchiolitis with respiratory distress	9	0.2	10	Discharged
38	10035958	Sahitya	8years/female	Bronchopneumonia	4	0.36	3	Discharged
39	10035994	Manasi	10year/female	Empyema	6	0.355	6	Discharged
40	10035999	Naman	11year/male	Aspiration pneumonia	5	0.366	5	Discharged
41	10035441	Md devodi	8year/male	LRTI	4	**0.768**	**3**	Discharged
42	10036021	yashit	11years/male	Nephrotic syndrome	3	**0.865**	**3**	Discharged
43	10036357	Naman	16years/male	Dengue	5	0.322	4	Discharged
44	10037557	vittal	15years/male	Sturge weber syndrome	6	0.222	3	Discharged
45	10037666	Tamim	18months/male	Spastic CP WITH aspiration pneumonia	5	0.184	2	Discharged
46	10038804	b/o sujata	15months/male	Bronchiolitis	4	**0.742**	**3**	Discharged
47	10038817	b/o arpitha	2 years/female	LRTI	2	**0.754**	**2**	Discharged
48	10039190	AARABH	3 year/male	Acute GE with dehydration	1	**1.142**	**3**	**AMA**
49	10039203	padmavathi	8 years/female	Dengue	3	**0.651**	**7**	Discharged
50	10040872	Satish	3 years/male	Nephrotic syndrome	3	0.384	3	Discharged
51	10040939	Chandrika	11year/male	**ARDS**	7	0.189	2	**DEATH**
52	10041095	Kartik	7 years/male	Kawasaki disease	4	0.268	3	Discharged
53	10041187	Fariz	2years/male	ARDS	6	0.114	4	Discharged
54	10041227	Manikanth	14years/male	Bronchopneumonia	6	0.374	4	Discharged
55	10041384	Prakash	16year/male	Type 1 with DKA	5	0.38	4	Discharged

56	10041410	preetam	10 years/male	GDD with dengue	7	0.322	2	Discharged
57	10041444	swapnil	17years/male	Thalassemia	2	0.314	2	Discharged
58	10041458	Bhuvan	18 months/male	ARDS	6	0.287	9	Discharged
59	10041475	Armaan	3years/male	Bronchopneumonia with anemia	4	0.408	5	Discharged
60	10041772	pratiksha	3years/female	RETT syndrome with inotropic refractory shock	16	0.26	12	Discharged
61	10041931	Nandish	2 years/male	Bronchiolitis	3	**0.629**	3	Discharged
62	10042097	Aditya	5 years/male	Left severe empyema	5	0.344	4	Discharged
63	10041357	Vedant	1years/male	Hepatic encephalopathy	8	0.26	6	Discharged
64	10042527	Bhavesh	8 years/male	Epileptic enecephalopathy	5	0.41	4	Discharged
65	10043015	Shreeraksha	3 years/female	Bronchopneumonia with pleural effusion	5	0.34	7	Discharged
66	10043085	sara	10years/female	Bronchial asthama	3	**0.752**	**2**	Discharged
67	10043383	sneha	14year/female	Acute pancreatitis	4	0.36	4	Discharged
68	10043877	Rashmi	14 year/female	Viral hepatitis	4	0.33	3	Discharged
69	10043231	Prajwal	7 years/male	SDNS	3	0.406	3	Discharged
70	10044515	Samanvi	4 year/female	SRNS	3	0.364	7	Discharged
71	10045763	Mallappa	14 year/male	Fulminant hepatitis with refractory shock	16	0.273	14	Discharged
72	10043505	b/o saraswati	16 months/male	TEF operated	15	0.301	13	Discharged
73	10046925	Samrudha	11year/male	LRTI with pneumonia	6	0.35	6	Discharged
74	10047433	Amogh	16year/male	Acute viral hepatitis	4	0.394	3	Discharged
75	10048023	Rajweer	2year/male	Right lobar pneumonia	5	**0.697**	**5**	Discharged
76	10048638	Samanvi	3 years/female	Mercury poisoning	0	**0.916**	**1**	Discharged
77	10049336	b/o rupali	1 year/male	WALRI with cong hypothyroidism	2	**0.67**	**1**	Discharged
78	10049691	Bhuvangowda	9year/male	Bacterial meningitis	4	0.382	3	Discharged
79	10049803	sonali	17year/female	Dengue fever with warning signs	8	0.336	7	Discharged
80	10051950	Mrunak	8 year/male	Liver abscess	7	0.346	5	Discharged
81	10054312	Abdul wahid	3 year/male	Hepatitis A	6	0.328	5	Discharged
82	10056436	Prathvi hiremath	8 year/male	Enteric fever	0	**0.854**	**7**	Discharged
83	10056910	Satwik singh	7 year/male	SRNS with infective relapse	8	0.346	6	Discharged
84	10057471	siddhart	8 months/male	DORV ,mild PS with SAM	12	0.218	15	Discharged
85	10057985	Ayesha	8 years/female	Leptospirosis	11	0.365	4	Discharged
86	10057995	Akshata	7 year/female	Rhabdomyosarcoma	5	0.386	5	Discharged
87	10058738	Raj nandini	1 year/female	Acute diarroheal illness with septic shock with AKI	18	0.198	11	Discharged
88	10058711	Yash	11 year/male	Dengue fever in critical phase	7	0.33	5	Discharged
89	10058893	Shivansh	1 year/male	Cerebral palsy secondary to perinatal insult	8	0.369	3	Discharged

90	10059170	sairaj	15 year/male	Dengue fever without signs	0	**0.602**	**3**	Discharged
91	10059392	Soumya	12 year/female	Atypical uremic syndrome	9	0.326	5	Discharged
92	10059404	prathviraj	9 months/male	WALRI	7	0.354	5	Discharged
93	10059418	shivakumar	3 year/male	Pneumonia with cerebral palsy	10	**0.318**	8	Discharged
94	10059831	vedha	1 year/female	Nephrotic syndrome	4	**0.854**	8	Discharged
95	10060297	mehaboob	13year/male	pneumonia	3	**0.61**	10	Discharged
96	10061156	somaria	8year/male	febrile encephalopathy with respiratory failure in shock	11	0.306	8	Discharged
97	10060641	raaj	11 year/male	acute gastroenteritis	2	0.328	3	Discharged
98	10060894	raju	14year/male	Dengue fever	5	0.365	5	Discharged
99	10060948	yogesh	13year/male	meningitis	3	**0.768**	6	Discharged
100	10060950	arush	10months/male	scorpian bite	1	**1.142**	2	Discharged
101	10061244	bhuvan	11year/male	dengue fever	3	0.369	3	Discharged
102	10061503	simran	18 months/female	febrile seizures	4	0.414	3	Discharged
103	10060851	shashikala	9years/female	steriod resistant nephrotic syndrome	5	0.346	10	Discharged
104	10061909	vinayak	1y 5months/male	Burns	6	0.216	3	Discharged
105	10062159	sushant	3 months/male	TAPVC	3	0.38	1	**SHIFT TO OT**
106	10062181	Mauli	1 year/male	bronchopnemounia with sepsis	9	0.328	6	Discharged
107	10063248	Arbina	11 year/male	Type 1 DM with DKA	4	0.364	5	Discharged
108	10063270	agastya	1 year/male	Acute GE with AKI	5	0.298	3	Discharged
109	10063396	abhjeet	9year/male	GBS	4	0.288	4	**DEATH**
110	10063510	Shruthi	16years/female	dengue fever	3	0.387	4	Discharged
111	10063665	manjunath	16years/male	dengue fever	2	0.367	4	Discharged
112	10063457	madivalappa	10years/male	asthama	1	0.298	3	Discharged
113	10063823	aaradhya	9 months/female	dilated cardiomayopathy	2	0.36	2	Discharged
114	10064408	agastya	1 year/male	AKI secondary to urosepsis	3	0.345	3	Discharged
115	10064750	vishnu	8 years/male	acute GE with some dehydration	3	0.314	3	Discharged
116	10064772	taiyba	15years/female	Congenital adrenal hyperplasia	2	0.324	2	**AMA**
117	10064999	pratham	13 years/male	Wilson disease	8	0.188	3	**AMA**
118	10064998	md azaan	13 years/male	dengue fever	2	0.324	10	Discharged
119	10065024	chetan	11year/male	Type 1 DM	4	0.362	8	Discharged
120	10051438	Alisha	9 year/female	Viral hepatitis A	3	0.298	2	**AMA**
121	10066011	Prajwal	15years/male	viral hepatitis A	1	0.284	4	Discharged
122	10066720	Sujal	15 years/male	Meningitis	2	0.362	2	Discharged

123	10067318	babu	14 years/male	Obstructive hydrocephalus	2	0.374	1	**AMA**
124	10067585	Aizan	10months/male	dengue fever	4	**0.74**	3	Discharged
125	10067634	arsalan	3 year/male	CML	4	0.365	2	Discharged
126	10067705	Hajarabi	9 months/male	Op/c/o TGA with AGE	3	0.312	3	Discharged
127	10067710	Aishwarya	17years/female	Seizure under evaluation	2	0.318	3	Discharged
128	10067799	Jyoti	18 months/female	Seizure under evaluation	3	0.408	6	Discharged
129	1006825	Moshin	15 years/female	Pleural effusion	4	0.362	8	Discharged
130	10068564	Raguveer	14years/male	PSGN	3	0.287	3	Discharged
131	10068584	amulya	13 years/female	Appendicitis	2	0.362	1	**SHIFT TO OT**
132	10068757	Divya	17 years/female	Post Renal transplant	7	0.212	8	Discharged
133	10068973	Zain	13years/male	medulloblastoma	1	0.341	2	Discharged
134	10068831	samanvi	18 months/female	Fever with ALL	2	0.326	4	Discharged
135	10068987	Prachi	2 years/female	ARDS	5	0.376	6	**AMA**
136	10054713	Shraddha	17 years/female	pulmonary TB	3	0.382	3	Discharged
137	10069480	Zuhan	3 months/male	Seizure under evaluation	2	0.284	3	Discharged
138	10069717	Pramod	4 year/male	acute GE	0	**0.629**	1	Discharged
139	10070087	Mohammad	11 year/male	autoimmune hepatitis	7	0.21	8	Discharged
140	10070077	akul	13 year/male	dengue fever	1	0.651	2	Discharged
141	10070108	suchit	10 year/male	Dengue fever with warning signs	4	0.38	4	Discharged
142	10070157	Parth	3 year/male	Mumps with septic shock	8	0.298	6	Discharged
143	10070249	Aradhya	8 year/female	Acute gastroenteritis with some dehydration with ALL	5	0.36	3	Discharged
144	10070805	Soujanya	5months/female	pulmonary atresia with severe RVH	2	0.347	3	Discharged
145	10070525	Manikanth	16 years/male	dengue fever	1	0.345	5	Discharged
146	10070845	Shraddha	17 years/female	TB meningitis	3	0.294	5	Discharged
147	10070905	Soujanya	5 momths/female	VSD	0	**0.784**	2	Discharged
148	10073152	Venkatesh	1 year/male	septic shock	10	0.21	10	**AMA**
149	10072707	nikhil	15 year/male	Acute pancreatitis	8	0.2	6	Discharged
150	10073719	Anushree	9 months/female	Aspiration pneumonia	2	**0.642**	5	Discharged
151	10074221	Basavaraj	14 year/male	Nephrotic syndrome	0	**0.752**	2	Discharged
152	10074216	Yuvaraj	2 year/male	bronchopneumonia	2	0.364	4	Discharged
153	10074404	Vedant	4 year/male	Seizure under evaluation	0	0.214	4	Discharged
154	10074660	Akshay	4year/male	dengue fever	2	0.346	3	Discharged
155	10075165	pramod	6year/male	bronchopneumonia	3	**0.662**	4	Discharged

156	10075527	Fardeen	15 year/male	Viral enecephalitis	9	0.226	7	Discharged
157	10075535	prabhulingayya	17 year/male	Rhemuatic heart disease	3	0.345	2	Discharged
158	10075560	B/o tanjeela	1 year/male	bronhilitis	1	**0.754**	2	Discharged
159	10075699	B/o tejaswini	4 months/male	CHD with hydrocephalus	6	0.294	4	Discharged
160	10075723	Laxman	3 months/female	dilated cardiomayopathy	3	0.36	2	Discharged
161	10075904	deepa	8 years/female	hepatitis A	6	0.314	4	Discharged
162	10075995	Anushree	7 years/female	dengue fever	3	0.398	3	Discharged
163	10076086	Preeti	16 years/male	DKA	4	0.294	6	Discharged
164	10076100	Pragathi	12years/female	hepatitis A	6	0.314	4	Discharged
165	10076130	Bilbis	16 years/female	Hepatic encephalopathy	8	0.288	10	Discharged
166	10076687	gagan	11 months/male	AKI secondary to urosepsis	2	**0.622**	4	Discharged
167	10077148	Tabsam	1 year/female	LRTI	0	**0.748**	2	Discharged
168	10077155	Zain	14year/male	medulloblastoma	1	0.398	2	Discharged
169	10078460	rohith	12years/male	dengue fever	1	**0.662**	3	Discharged
170	1007872	Tejas	3y 4 m/male	WALRI with CAH	2	0.296	3	Discharged
171	10077408	Balu	2 months/male	TOF	3	0.31	2	**AMA**
172	10076749	Md arsalan	7 years/male	dengue fever	1	0.39	2	Discharged