

# The Impact of Hematological Parameters on Speech Therapy Outcomes in Neurological Patients: A Mixed-Methods Study

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## Abstract

This study examines the link between blood parameters, specifically hemoglobin and inflammation markers, and progress in speech therapy for individuals with neurological disorders. Using a mixed-methods approach, we tracked 100 patients in speech therapy to determine how conditions like anemia and inflammation affected their rehabilitation. The quantitative results showed that patients with higher hemoglobin levels had better outcomes, while those with elevated C-reactive protein (CRP) had poorer progress. Qualitative interviews revealed that fatigue and reduced motivation, often linked to anemia and inflammation, impacted patients' participation. These findings underscore the importance of managing hematological health to optimize speech therapy, suggesting a collaborative approach involving multiple healthcare specialists.

**Keywords:** Blood Parameters, Anemia, Inflammation, Speech Therapy, Neurological Disorders, Rehabilitation, Hemoglobin, C-Reactive Protein

## Introduction

Speech and language challenges often arise in people with neurological issues, and effectively managing these challenges requires more than just a focus on speech and cognition. Physical health, particularly factors like anemia and inflammation, can play a crucial role in therapy outcomes. Conditions like anemia and chronic inflammation have been linked to diminished cognitive function, which could influence patients' abilities to engage in speech therapy effectively (Dubruille et al., 2015).

Iron deficiency anemia, for example, can lead to problems like poor attention and delayed language skills, especially in children (Lozoff, 2007). Low hemoglobin levels mean the brain isn't getting enough oxygen, which may affect neuroplasticity and the capacity to benefit from speech therapy. Similarly, high levels of inflammation markers like CRP have been linked to reduced cognitive performance in older adults, which might also impact speech rehabilitation (Dik et al., 2005).

Despite what we know, there isn't enough research specifically connecting these hematological factors to speech therapy outcomes. Gaining a better understanding of this connection could help us improve therapy by tackling both physiological and speech-related issues simultaneously. This study aims to explore how blood-related factors impact speech therapy progress for people with neurological disorders and to offer insights into more personalized rehabilitation strategies.

## Literature Review

The relationship between blood health and cognitive and speech outcomes is gaining interest, particularly for those with neurological impairments. This review will look at how anemia and inflammation markers affect cognitive and speech performance.

### Anemia and Cognitive Function

Anemia, especially iron deficiency, is well-known for its negative effects on cognitive abilities. Lozoff (2007) found that iron-deficient children often experience slower cognitive development, attention issues, and language delays. These challenges can hinder their ability to benefit fully from speech therapy. Similarly, Dubruille et al. (2015) highlighted that low hemoglobin levels reduce the brain's oxygen supply, which is essential for learning and adapting—key processes in speech rehabilitation (Su et al., 2015).

Older adults with anemia also face cognitive declines, affecting memory, attention, and processing speed, all of which are crucial for speech therapy (Yavuz et al., 2012). This suggests that treating anemia might improve the effectiveness of speech therapy, especially for patients dealing with neurological issues.

### Inflammation and Cognitive Function

Chronic inflammation, which includes markers like CRP and IL-6, is another factor linked to cognitive decline. Dik et al. (2005) showed that elevated CRP levels were associated with poorer cognitive performance in older people. Inflammation can negatively affect brain plasticity, which is vital for learning during speech therapy (Allan et al., 2005). Patients dealing with high inflammation often report increased fatigue and lower motivation, which can interfere with the active participation needed in therapy sessions (Straub, 2015).

For example, Sartori et al., (2012) found that people with higher inflammation experienced quicker cognitive decline, especially those with neurological problems like stroke. Addressing inflammation could therefore be an important way to boost speech therapy success.

### Hematological Factors and Speech Therapy Outcomes

While there has been plenty of research linking anemia and inflammation to cognitive issues, fewer studies have looked at their impact on speech therapy specifically. Factors like anemia and inflammation can directly affect critical cognitive functions such as attention and memory, which are important for communication and language skills (Dubruille et al., 2015). Understanding how these blood-related issues affect speech therapy could help develop better, personalized interventions.

Santos et al., (2009) conducted a study on iron supplementation in children undergoing speech therapy for anemia and found that those who received supplements showed greater improvements compared to those who did not. Griffith et al., (2016) also pointed out the importance of managing systemic inflammation during speech therapy, noting that reduced inflammation can enhance patient engagement.

## Gaps in the Literature

Despite the connections between anemia, inflammation, and cognitive health, there is a lack of research that looks specifically at speech therapy outcomes. Existing studies tend to focus on general cognitive issues rather than the unique needs of those in speech rehabilitation. Additionally, few researchers have explored interventions aimed at minimizing the negative effects of anemia and inflammation on speech therapy. More work is needed to define how these factors should be managed in patients undergoing speech therapy, particularly for those with neurological impairments.

The literature suggests that blood health, particularly factors like anemia and inflammation, plays a significant role in cognitive abilities that affect speech therapy. By managing these issues, we could improve the effectiveness of speech rehabilitation for patients with neurological conditions. This study aims to fill this gap by examining the link between blood health and speech therapy progress, ultimately working towards better, more personalized rehabilitation approaches.

## Methodology

This research used a mixed-methods approach, combining numbers and stories to explore how blood health impacts speech therapy progress in patients with neurological conditions. We recruited 100 participants from a tertiary hospital who had been receiving speech therapy for at least three months.

## Participants and Sampling

Participants were recruited from the hospital's neurology and rehabilitation departments. To be included, patients had to have a neurological condition affecting their speech, agree to participate, and not have received recent blood transfusions. We excluded anyone with other health issues that might independently impact their speech and language abilities.

## Data Collection

We collected data over six months. Hematological markers, like hemoglobin and CRP levels, were gathered from participants' medical records. Speech progress was measured using tools like the Western Aphasia Battery (WAB) and the Boston Naming Test (BNT), administered at the beginning and end of the study.

We also conducted semi-structured interviews with participants and their therapists to understand their experiences. These interviews focused on their day-to-day experiences with therapy, any challenges they faced, and their overall impressions of progress.

## Data Analysis

We used SPSS to analyze the numerical data. We first summarized participants' information and looked for relationships between hemoglobin, CRP, and speech progress. We also conducted regression analyses to understand how these blood markers influenced outcomes, accounting for age and initial cognitive levels.

The qualitative data from interviews were analyzed through thematic analysis. We transcribed the interviews and identified recurring themes, focusing on how participants felt about therapy and what factors seemed to influence their progress.

#### Ethical Considerations

The ethics committee approved the study. All participants provided informed consent, knowing they could withdraw at any time. Their data were anonymized for privacy, and we stored all information securely.

#### Findings

The quantitative results of this study revealed some notable connections between blood health and speech therapy outcomes. Specifically, we found that certain blood markers seemed to play an important role in patients' progress.

Table 1 gives an overview of the participants' characteristics, while Table 2 shows how hemoglobin levels and C-reactive protein (CRP) are related to therapy progress.

**Table 1: Participant Demographics**

Characteristic	Frequency (n=100)
Age (mean $\pm$ SD)	52.3 $\pm$ 13.7 years
Gender (Male/Female)	58/42
Neurological Condition	Stroke (45), TBI (30), Others (25)

**Table 2: Correlations Between Hematological Parameters and Therapy Outcomes**

Parameter	Correlation with Therapy Progress (r)	p-value
Hemoglobin Level	0.45	0.001
CRP Level	-0.37	0.005

The data showed that patients with higher hemoglobin levels tended to make more progress in their speech therapy sessions ( $r = 0.45$ ,  $p < 0.01$ ). Essentially, the more oxygen-carrying capacity their blood had, the better they seemed to do in therapy. On the other hand, patients with higher CRP levels, which indicate inflammation, showed slower progress ( $r = -0.37$ ,  $p < 0.01$ ). This suggests that inflammation might be a barrier to making gains in speech rehabilitation.

#### Qualitative Findings

Through the interviews, we identified several key themes.

##### Theme 1: Fatigue and Therapy Engagement

- **Physical Fatigue:** Many participants noted that anemia-related fatigue made it difficult to engage in therapy. One participant said, "I often felt too tired to concentrate during therapy, especially on days when my hemoglobin was low."
- **Mental Fatigue:** High inflammation also contributed to a feeling of "brain fog," affecting motivation. Therapists observed that patients with higher inflammation struggled to stay focused.

### Theme 2: Motivation and Progress

- Role of Inflammation: Participants described feeling less motivated during periods of high inflammation. One participant said, "On days when my inflammation was up, I just couldn't focus as much."
- Therapist Support: Therapists played a key role in adapting to these challenges. One therapist shared, "When my patients were struggling, I tried to adjust sessions to their energy levels, offering more rest breaks."

### Theme 3: Perceived Effectiveness of Therapy

- Hemoglobin and Focus: Some participants noticed improvements in their focus as their hemoglobin levels increased. One said, "After starting iron supplements, I could focus better and my speech improved."
- Daily Communication: Improved blood health also translated to better communication at home, with participants feeling more capable of engaging in conversations with family.

## Discussion

The results show that blood health—particularly hemoglobin and CRP levels—plays an important role in how well patients progress in speech therapy. Higher hemoglobin was associated with better outcomes, possibly because it boosts oxygen flow to the brain, supporting neuroplasticity and learning (Lozoff, 2007; Dubruille et al., 2015). Improved hemoglobin levels through interventions like iron supplementation could make therapy more effective.

Elevated CRP levels, which indicate inflammation, were linked to worse outcomes. Chronic inflammation affects brain function and leads to fatigue, making it hard for patients to fully engage in therapy (Dik et al., 2005). This finding was echoed in the qualitative interviews, where patients and therapists noted that high inflammation led to both physical and mental fatigue, reducing therapy participation.

The study highlights the need for a multidisciplinary approach that includes speech therapists, physicians, and other healthcare providers to address these blood-related challenges. By managing anemia and inflammation alongside speech therapy, we can provide a more holistic and effective rehabilitation plan for neurological patients.

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