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Original Research Article

The Burden of Malnutrition and Stunted Growth among Homozygous Children with Sickle Cell Disease Compared to Healthy Controls in Mbujimayi

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Abstract: ***Introduction*:** Sickle cell disease is a common genetic disorder in Sub-Saharan Africa, frequently associated with impaired growth and malnutrition in children. ***Objective*:** To compare the nutritional status and growth profile of children with homozygous sickle cell disease (HbSS) and healthy controls in Mbujimayi. ***Methods*:** A prospective, comparative, analytical study was conducted from November 2025 to March 2026. Seventy-one HbSS children and 69 age- and sex-matched controls (12 months–10 years) were included. Nutritional status was assessed using WHO anthropometric standards. Statistical analysis included Chi-square test, Student's t-test, odds ratios, and relative risks ($p < 0.05$). ***Results:*** Malnutrition and stunting were significantly higher in HbSS children compared with controls (59% vs 1%, $p < 0.001$). Sickle cell disease was associated with an increased risk of malnutrition (RR = 3.28; 95% CI: 2.40–4.44). ***Conclusion*:** Children with sickle cell disease present significantly impaired nutritional status, emphasizing the need for early nutritional assessment and targeted interventions.

Keywords: Sickle Cell Disease, Children, Growth, Nutrition, Stunting, Anemia, DR Congo.

INTRODUCTION

Sickle cell disease is an autosomal recessive genetic disorder characterized by the presence of hemoglobin S (HbS). Under deoxygenated conditions, HbS polymerizes, leading to red blood cell deformation into a sickle shape. These rigid and fragile cells result in chronic hemolysis and recurrent vaso-occlusive episodes [1].

Sickle cell disease is one of the most common inherited disorders worldwide and represents a major public health issue, particularly in Sub-Saharan Africa, where most affected births occur [2]. Despite advances in diagnosis and management, the disease remains associated with significant morbidity due to recurrent acute and chronic complications.

In children, it is mainly characterized by chronic hemolytic anemia, recurrent vaso-occlusive crises, infections, and multiorgan involvement. Beyond these complications, sickle cell disease has a major impact on growth and nutritional status. This impairment is multifactorial, involving increased metabolic demand due to chronic hemolysis, persistent inflammation, tissue hypoxia, recurrent infections, and reduced nutritional intake [3,4].

These disturbances often result in underweight, reduced body mass index, and stunted growth, which may begin early in life and negatively affect development and quality of life [5]. Therefore, regular assessment of growth and nutritional status is essential, especially in low-resource settings.

In Mbujimayi, data on the nutritional status of children with sickle cell disease remain limited, highlighting the need for local evidence to guide early identification and management of malnutrition.

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OBJECTIVES

General Objective

To assess the growth profile and nutritional status of children with homozygous sickle cell disease (HbSS) compared with non-sickle cell children (HbAA) in Mbujimayi.

Specific Objective

- To compare anthropometric characteristics and nutritional status between HbSS children and healthy controls
- To determine the prevalence of stunting among HbSS children.
- To evaluate the risk of malnutrition associated with sickle cell disease compared with non-sickle cell children.

MATERIALS AND METHODS

This was a prospective, comparative, analytical study conducted at the Pediatric Clinic of Mbujimayi, Democratic Republic of Congo, over a five-month period (November 2025 to March 2026).

The study included 71 children with homozygous sickle cell disease (HbSS) and 69 healthy controls aged 12 months to 10 years, matched for age and sex. HbSS diagnosis was confirmed by hemoglobin electrophoresis.

Nutritional status was assessed using anthropometric measurements (weight and height) and interpreted according to WHO growth standards.

Clinical and sociodemographic data were obtained from medical records and standardized clinical examinations.

Statistical analysis was performed using Chi-square test and Student's t-test. Associations were expressed as odds ratios (OR) and relative risks (RR), with a significance level set at $p < 0.05$.

RESULTS

Sociodemographic Characteristics of the Study Population

The two groups were comparable in terms of age and sex ($p > 0.05$). However, a marked difference was observed regarding nutritional status. Stunting was present in 59% of children with sickle cell disease compared to 1% of healthy controls ($p < 0.0001$). Children with sickle cell disease had a significantly higher risk of malnutrition (RR = 3.28; 95% CI: 2.40–4.44). The table below illustrates these findings.

Table 1: Distribution of cases and controls according to age, sex, and nutritional status

Variables	Cases (Sickle cell disease) (n = 71)	Controls (Healthy) (n = 69)	p-value
Age (years)			
• Mean ± SD	7,4 ± 2	7,2 ± 2	0,557
Age groups			0,923
• ≤ 5 years	15 (21%)	15 (22%)	
• > 5 years	56 (79%)	54 (78%)	
Sex			0,063
• Male	43 (61%)	31 (45%)	
• Female	28 (39%)	38 (55%)	
Nutritional statut (WHO)			P < 0,0001*
• Normal	29 (41%)	68 (99%)	RR = 3,28 [2,40 – 4,44]
• Stunting (chronic malnutrition)	42 (59%)	1 (1%)	

** Fisher's exact test, RR: Relative Risk*

Nutritional Status and Renal Complications in Children with Sickle Cell Disease

The analysis of the relationship between nutritional status and glomerular involvement revealed a significant difference between children with growth retardation and those with normal growth. Children with malnutrition or stunting more frequently presented renal abnormalities such as microalbuminuria and/or macroalbuminuria.

Stunting was significantly associated with a higher risk of glomerular involvement (OR = 5.34; 95% CI: 2.05–13.87; $p < 0.0001$). These findings suggest that children with sickle cell disease who have impaired nutritional status may be more exposed to renal complications.

This observation reinforces the importance of regular nutritional monitoring in children with sickle cell disease in order to allow early detection of growth disorders and associated complications, as illustrated in the table below.

Table 2: Distribution of cases and controls according to anthropometric parameters

Nutritional statute (WHO)	Glomerular involvement present (MAL + macroalbuminuria)	No glomerular involvement	Odds Ratio IC95%	p-value
Malnutrition / stunting	37 (41,6%)	6 (11,8%)	5,34 [2,05 - 13,87]	< 0,0001* (OR = 5,34)
Normal	52 (58,4%)	45 (88,2%)		

*Chi-square (χ^2) = 13.01

DISCUSSION

This study demonstrates a significant impairment of growth and nutritional status among children with sickle cell disease compared with healthy controls in Mbujimayi.

Growth Retardation and Nutritional Status

Children with sickle cell disease showed a significantly higher prevalence of malnutrition and stunting. This finding is consistent with the international literature, which reports impaired growth in these patients starting from early childhood.

Several studies have confirmed a reduction in linear growth and body weight among children with sickle cell disease, associated with impaired body composition [6,7].

Pathophysiological Mechanisms

This nutritional impairment is multifactorial. It is mainly explained by chronic hypermetabolism resulting from hemolytic anemia, which leads to an increase in basal energy requirements. Recurrent infections and chronic inflammatory episodes further contribute to worsening malnutrition.

Singhal *et al*., demonstrated that children with sickle cell disease have a significantly increased resting energy expenditure, contributing to nutritional imbalance [8].

African and Local Context

In Sub-Saharan Africa, malnutrition is even more common among children with sickle cell disease due to unfavorable socioeconomic conditions. A recent literature review highlights that sickle cell disease is strongly associated with growth retardation across several African countries [9].

In the Democratic Republic of the Congo, similar findings have been reported, confirming significant growth retardation among these children [10].

CONCLUSION

This study shows that children with homozygous sickle cell disease (HbSS) in Mbujimayi have a significantly poorer nutritional status compared with healthy children, with a high prevalence of malnutrition and stunting. The risk of malnutrition is approximately three times higher in affected children.

These findings highlight that sickle cell disease is not limited to acute clinical complications but also has a silent and chronic impact on child growth. In this context, early and regular nutritional monitoring is essential to support optimal growth, improve long-term outcomes, and enhance quality of life.

Current State of Knowledge on Nutritional Status in Sickle Cell Disease

Sickle cell disease (SCD) is frequently associated with growth impairment and malnutrition in children, particularly in Sub-Saharan Africa. Affected children often present with stunting and underweight due to chronic hemolysis, increased metabolic demands, recurrent infections, and inflammation. Socioeconomic constraints further worsen nutritional outcomes in low-resource settings. Although this association is well established in the literature, data from Central Africa, including the Democratic Republic of Congo, remain limited, justifying local studies to better characterize the nutritional burden in this population.

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Conflicts of Interest: The authors declare that they have no conflicts of interest. The authors are solely responsible for the content and writing of this article. The study questionnaire was submitted and approved by the ethics committee of the Mashi Research Centre, sickle cell disease and other red blood cell diseases (N/Ref: 007/CR/CRM/CPM/YMK/2026). Written informed consent was obtained from each participant. All the data generated or analysed during this study are available from the author upon request.

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