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Dysglycaemia and Clinical Outcomes in Under-Five Children with Severe Acute Malnutrition in Federal Teaching Hospital, Birnin Kebbi

Falaye Adejoke M, Tahir Ali A, Abubakar Mansur, Lawal Taslim O

Department of Paediatrics, Federal Teaching Hospital, Birnin Kebbi, Kebbi State, Nigeria.

Correspondence

Dr Falaye Adejoke M., Federal Teaching Hospital, PMB 1126, Birnin Kebbi, Nigeria.
E-mail: falayeadejoke@gmail.com ; ORCID - https://orcid.org/0009-0006-8342-4045.

Abstract

Background: Severe acute malnutrition (SAM) remains a critical public health issue globally, contributing substantially to illness and death among children under five. Despite the clinical significance of glucose metabolism, data on the burden and outcomes of dysglycaemia in malnourished children, particularly in low-resource settings like Nigeria, are limited.

Objective: To determine the prevalence of dysglycaemia and its relationship with clinical outcomes in children with SAM at the Federal Teaching Hospital, Birnin Kebbi.

Methods: This was a cross-sectional study of children aged 6 months to 5years with WHO-defined SAM presenting at the EPU from 1st September to 31st August 2024. A Google Form was used to obtain relevant sociodemographic and clinical information, and random blood glucose (RBS) was measured on admission, at 24 hours, and on alternate days.

Results: The study population was 132, comprising 36 males and 96 females, with most (54.5%) aged 1 to <3 years. At 24 hours post-admission, 11.4% had dysglycaemia: 2.3% with hypoglycaemia and 9.1% with hyperglycaemia. The majority (80%) with dysglycaemia had delayed stabilisation time after admission, and their median length of stay (LOS) was 14 days (IQR 10-18days). The overall mortality rate in children with SAM and dysglycaemia was 4.5%. The six fatalities comprised five children with hyperglycaemia and one with hypoglycaemia.

Conclusion: The findings in the study emphasise the significant morbidity associated with dysglycaemia in children with SAM and its link to increased mortality. This highlights the critical need for routine glucose monitoring and prompt management of its disorders to improve clinical outcomes.

Keywords: Glucose metabolism, Hyperglycaemia, Hypoglycaemia, Severe acute malnutrition, Severe wasting.

Introduction

Severe acute malnutrition (SAM) remains a major global child-health crisis. Globally, an estimated 10–13 million children were classified with SAM in 2022–2024, and severe wasting continues to be a leading driver of mortality among children under five years of age. [1] The burden is concentrated in South Asia and sub-Saharan Africa. Nigeria alone faces a significant challenge, being home to an estimated 1.8–2.0 million children with acute malnutrition, and the northeastern and northwestern states are especially affected. [2]

Dysglycaemia, a condition encompassing both abnormally low (hypoglycaemia) and high (hyperglycaemia) blood glucose, is a frequently

encountered and often overlooked complication in children with SAM. [3] Its pathophysiology is complex; hypoglycaemia typically results from depleted glycogen stores, while hyperglycaemia is often a manifestation of stress-induced metabolic changes and insulin resistance.[4] Both conditions are strongly associated with increased morbidity and mortality in this vulnerable population. Studies from similar regional settings support this, with research in Uganda showing that stress hyperglycaemia is common and linked to increased mortality. [3] Similarly, a study in Southern Nigeria identified dysglycaemia as a key predictor of inpatient mortality among hospitalised children with SAM.[5] A systematic review and meta-analysis further underscore the strong association between dysglycaemia and poor clinical outcomes in children with SAM. [4]

Despite the well-documented effects of dysglycaemia on the clinical course of SAM, studies specifically investigating its prevalence and relationship with clinical outcomes in the Nigerian context are relatively few. [6, 7] While a recent Nigerian research has explored the broader burden of SAM and its associated mortality in the northern region, six other studies have investigated dysglycaemia in general acutely ill paediatric populations, [7, 8]. A critical knowledge gap remains regarding its specific impact on children with SAM. The unique epidemiological and clinical characteristics of SAM in different geographical regions necessitate localised research to guide evidence-based management protocols. To the best of this team of researchers' knowledge, no study has specifically examined the prevalence and outcomes of dysglycaemia in children with SAM in Birnin Kebbi. This study was therefore undertaken to determine the prevalence of dysglycaemia and its relationship with clinical outcomes in hospitalised children diagnosed with severe acute malnutrition in northern Nigeria. The findings are expected to provide valuable localised data, adding to the current body of knowledge and guiding the development of more effective management strategies for SAM in the region.

Methods

Study area

The study was conducted at the Federal Teaching Hospital, Birnin Kebbi, a tertiary healthcare institution in Birnin Kebbi, the capital of Kebbi State, Nigeria. Situated in the northwestern region of the country, [9] Kebbi State spans a landmass of 36,985 km². It is bordered by the Republics of Niger and Benin, and the Nigerian states of Niger, Zamfara, and Sokoto. With a projected 2024 population of over 4.4 million, the State has a predominantly young demographic and is home to various ethnic groups, including the Fulani, Hausa, and others. The hospital is a well-equipped facility with a capacity of over 300 beds and is staffed by highly qualified medical professionals. [9]

Study population

The study population comprised children aged 6 months to 5 years diagnosed with severe acute malnutrition (SAM) who presented with dysglycaemia at the point of admission to the hospital's Emergency Paediatric Unit (EPU). This group of sick children were recruited into the study over one year, from September 2023 to August 2024.

Inclusion and exclusion criteria:

a) Children with SAM as defined according to WHO criteria (Weight-for-height/length Z-score <-3 Standard Deviations, or Mid-Upper Arm Circumference < 11.5 cm, or presence of bilateral pitting oedema).
b) Those whose random blood glucose (RBS) levels were < 3.0 mmol/L or > 11.0 mmol/L at admission. Children with known diabetes mellitus or other chronic metabolic disorders, in shock,

hypothermic or who had prior dextrose infusion were excluded from the study.

Ethical considerations

The study protocol was reviewed and approved by the Ethics and Research Committee of the Federal Teaching Hospital, Birnin Kebbi (H/BK/HP/045/P/517/VOL.V/069). Informed consent was obtained from parents in their local languages before participation in the study. Confidentiality of patient data was also maintained throughout the study.

Sample size determination and sampling technique

The sample size was calculated using the formula below, using the prevalence of SAM in the unit (9%):

$n = Z^2 \times P(1-P)/d^{2;}$ where Z = 1.96 (for a 95% confidence level), P = 0.09 (the new prevalence) and d = 0.05 (the desired precision or margin of error).

Thus, n = approximately 126. To adjust for non-response and attrition, using a response rate of 90%, the final sample size was 140.

A total of 140 SAM children were consecutively recruited into the study, but the data of eight children were lost during data collection, collation and analysis; thus, the data of 132 children were analysed. These children were consecutively recruited on a non-probability basis.

Data collection

Upon admission to the EPU, they were resuscitated and stabilised, after which verbal and written informed consent were obtained from their parents or legal guardians. An Accu-Chek™ Active Blood Glucose Meter (Roche Diabetes Care GmbH, Mannheim, Germany; Serial No. G12458973A) was used to measure RBS on admission and 24 hours post-admission. Baseline sociodemographic (age, gender, and socioeconomic class) and clinical information (weight, height, presenting symptoms, and duration of hospital stay) were obtained using a structured questionnaire on Google Forms. A trained research assistant was involved in recruitment and collection of data collection. The glucometer was calibrated daily according to the manufacturer's instructions. A questionnaire was adapted from previous studies [3, 5] to assess the effect of dysglycaemia in SAM. Some experts had validated the research instrument by reviewing its content, relevance, and structure. A pilot study involving about 14 participants was conducted at the EPU to refine the questionnaire and clarify ambiguities.

Definitions:

- Hypoglycaemia was defined as a Random Blood Sugar (RBS) level of less than 3.0 mmol/L (< 54 mg/dL).
- Hyperglycaemia was defined as a Random Blood Sugar (RBS) level greater than 11.0 mmol/L (> 198 mg/dL).
- Euglycaemia was defined as an RBS level between 3.0 mmol/L and 11.0 mmol/L (inclusive).
- Dysglycaemia encompasses both hypoglycaemia and hyperglycaemia.

Clinical outcome assessment

All enrolled subjects were followed up from admission until their clinical outcome, which was categorised as either discharge (improved and stable enough to be sent home), SAMA (sign against medical advice or premature self-discharge) or death was determined. The time of stabilisation and the length of hospital stay were also recorded.

Data management and analysis

The data were entered into IBM® SPSS Statistics (version 26) for analysis. Descriptive statistics, including frequencies and percentages, were used to summarise demographic characteristics and the prevalence of dysglycaemia. The Chi-square ($\chi 2$) test was used to determine the association

between dysglycaemia and clinical outcomes. A p-value of < 0.05 was considered statistically significant.

Results

The study participants showed a female preponderance (96 females vs. 36 males, with a male-to-female ratio of 1:2.6). The majority of the participants (54.5%; n = 72) were aged between 1 and <3 years with the mean age of 2.6±0.4 years as shown in Table 1.

Table I: Demographic characteristics

Characteristics	*Frequency (n)*	*Percentage*
Gender		
Male	36	27.3
Female	96	72.7
Age group		
6 months - <1 year	33	25
1 - <3 years	72	54.5
3 - 5 years	27	20.5
Total	132	100

The majority of the children (80.0%) with dysglycaemia had delayed stabilisation time after admission, with a median length of stay of 14 days (IQR 10-18days). The prevalence of dysglycaemia at 24 hours post-admission was 11.4% (n = 15). This group was further categorised as follows: 2.3% (n = 3) of the total study population had hypoglycaemia, and 9.1% (n = 12) had hyperglycaemia. The vast majority of the children (106; 80.3%) and (117; 88.6%) were euglycaemic at admission and at 24 hours post-admission, as shown in Table II.

The overall mortality rate in dysglycaemia associated with SAM was 4.5% and the mortality was higher in SAM children with hyperglycaemia than hypoglycaemia, but this was not statistically significant (p = 0.79).

Table II: Distribution of glycaemic status at 24 Hours post-admission

Clinical status	*At admission*	*At 24-hours*
Euglycaemia	106 (80.3)	117 (88.6)
Hyperglycaemia	12 (9.1)	12 (9.1)
Hypoglycaemia	14 (10.6)	3 (2.3)
Total	***132 (100.0)***	***132 (100.0)***

Table III: Outcome of children with SAM according to the glycaemic status on admission

Outcome/Glycaemic status	*Euglycaemia*	*Hyperglycaemia*	*Hypoglycaemia*
Discharge	114 (86.4)	7 (5.3)	2 (1.5)
Death	0 (0.0)	5 (3.8)	1 (0.7)
SAMA	3 (2.3)	0 (0.0)	0 (0.0)
Total	117	12	3

Discussion

The demographic profile of the study cohort is consistent with established epidemiological trends of SAM in sub-Saharan Africa. [1,2] The finding that the majority of participants (54.5%) were concentrated in the age group of 1 to <3years (with a mean age of 2.6 ±0.4years) confirms that the study captured children at the peak vulnerability stage for acute malnutrition. This age bracket, characterised by high nutritional demands and increased exposure to infections during the transition from breastfeeding, is where SAM often manifests most severely. Furthermore, the observed female preponderance, with a male-to-female ratio of 1:2.6, aligns with some regional studies, although global reports on gender differences in SAM prevalence remain variable. [6] Understanding this demographic context is vital for tailoring public health and nutritional interventions in the region.

A key finding was the overall prevalence of 11.4% for dysglycaemia at 24 hours post-admission. This rate is clinically significant, falling within the lower to mid-range of prevalence rates reported across African settings.[4] More importantly, the study elucidates

a critical pattern in the type of glucose metabolism disturbance in SAM, with hyperglycaemia occurring four times more than hypoglycaemia. This phenomenon — the strong predominance of hyperglycaemia — is highly suggestive of a severe, stress-induced metabolic state. Hyperglycaemia in SAM is typically an acute consequence of catabolic stress, elevated counter-regulatory hormones (like cortisol and glucagon), insulin resistance, and often reflects underlying systemic infection or sepsis.[3] Studies from southern Nigeria have similarly identified this pattern, emphasising that the body's inability to appropriately manage glucose under stress significantly complicates the clinical picture.[7,9] Conversely, the lower prevalence of hypoglycaemia, while still lethal, may suggest relatively effective initial triage and management adhering to WHO protocols for SAM, which prioritise the immediate detection and treatment of low blood glucose to prevent rapid deterioration. The fact that the vast majority of children with SAM (88.6%) were euglycaemic at 24 hours post-admission is a positive indicator of the efficacy of the standard SAM management protocol in restoring metabolic balance for the majority of patients.

The most pronounced impact of dysglycaemia in this study was on the course of recovery. A staggering 80% of subjects with dysglycaemia experienced a delayed time to clinical stabilisation, directly contributing to a significantly prolonged median length of hospital stay of 14 days, with an interquartile range of 10–18 days. This prolonged length of hospital stay is a critical finding. It not only exposes the vulnerable child to a heightened risk of hospital-acquired infections and further nutritional setbacks but also places a considerable burden on the limited resources of a tertiary health facility in a low-resource setting. [5] The need for an extended stay in children with metabolic complications underscores the importance of stringent clinical and metabolic monitoring to achieve rapid stabilisation. Conversely, the euglycaemic children, comprising 88.6% of the cohort, likely achieved stabilisation more quickly, demonstrating the direct clinical benefit of maintaining glucose homeostasis.

The overall mortality rate attributable to dysglycaemia in this study was 4.5%. When stratified by glycaemic status, more deaths in the cohort were hyperglycaemic. This finding is highly consistent with recent studies from Nigeria and other parts of Africa. [5,6] Research conducted in both southern and northern Nigeria affirms that hyperglycaemia is a powerful, independent predictor of inpatient mortality in SAM. [5,6] Tumwebaze *et al.* [3] in Uganda similarly concluded that stress hyperglycaemia is linked to increased adverse outcomes. This consistent regional evidence suggests that even in a study where the association did not reach statistical significance, the clinical trend remains highly alarming. The fatal outcome in five children with hyperglycaemia versus one with hypoglycaemia strongly suggests that severe metabolic stress and its underlying cause (e.g., severe sepsis) are more challenging to manage and carry a worse prognosis than the energy deficit state of hypoglycaemia, which is often more readily reversible with dextrose administration. [4]

Limitations

This study was a single-centre study, which may limit the generalizability of the findings to other regions or healthcare settings in Nigeria. Secondly, the cross-sectional design at 24 hours provides a snapshot of dysglycemia prevalence but does not fully capture the dynamic nature of glucose fluctuations throughout the hospital stay. Thirdly, blood glucose was measured using a glucometer, which, while practical for bedside monitoring, may have slight variations compared to laboratory-based measurements. Lastly, the study did not implement specific interventions for

hyperglycemia, which limits our ability to assess the impact of such interventions on outcomes.

Conclusion

This study from Birnin Kebbi, northern Nigeria, confirms that dysglycaemia, particularly hyperglycaemia, is a frequent and serious complication of SAM, directly associated with delayed recovery and contributing to mortality. The findings strongly advocate for the universal implementation of routine, frequent glucose monitoring for all hospitalised children with SAM, as recommended by WHO. Furthermore, given the observed predominance and clinical impact of hyperglycaemia, there is a clear need for standardised, aggressive management protocols for this condition within Nigerian and African SAM treatment centres, moving beyond the current focus primarily on hypoglycaemia. Future research should focus on randomised trials of specific hyperglycaemia intervention strategies tailored towards children with SAM.

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Conflicts of Interest: None declared.
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References

1. Levels and trends in child malnutrition: UNICEF/WHO/World Bank Group Joint Child Malnutrition Estimates. Key findings of the 2021 edition [Internet]. UNICEF. 2021.
2. Acute Malnutrition Analysis [Internet]. Integrated Food Security Phase Classification (IPC) Nigeria: IPCInfo. November 2024.
3. Tumwebaze A, Kiboneka E, Mugalu J, Kikabi EM, Tumwine JK. Prevalence and outcome of stress hyperglycaemia among severely malnourished children admitted to Mulago referral and teaching hospital in Kampala, Uganda. *BMC Nutr* 2018;4(2):49.
4. Elizabeth L, Phillips P, Allison D, Toby C, Andrew P, Robert H. Dysglycemia in Children with Severe Acute Malnutrition: A systematic review and meta-analysis. *Adv Nutr* 2021;12(3):959-63.
5. Okonkwo AA, Obu HA, Eke CB. Predictors of Inpatient Mortality of Severe Acute Malnutrition of Hospitalised Children in a Tertiary Facility in Southern Nigeria. *Ann Trop Paediatr* 2022;42(2):167-73.
6. Abubakar A, Bello M, Musa H, Ibrahim Z. Determinants of Mortality Among Severely Malnourished Children in Northern Nigeria. *J Trop Pediatr* 2022;68(1).
7. Oguche S, Okolo SN, Ezeonwu BU -. Prevalence of Severe Acute Malnutrition in Children Admitted to the Emergency Paediatric Unit at a Tertiary Centre in North Central Nigeria. Trop J Health Sci 2019;26(1):1-7.
8. Idris H, Okuonghae H. Determinants and outcome of dysglycaemia in a children's emergency ward, southwest Nigeria. West Afr J Med Sci. 2020;3(1):1-7.
9. Federal Medical Centre, BK. About us Birnin Kebbi: https://fmcbirninkebbi.gov.ng/home; 2025.