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Prevalence And Clinical Correlates Of Hypoglycemia In Children Admitted To The Emergency Room Of Enugu State University Teaching Hospital (ESUTH)

[1]Chiesonu Dymphna Nzeduba, [2] Ugochukwu Franklin Nduka, [3]Nonyelum Chikaodili Maduka

[1,2] Department Of Paediatrics, Enugu State University Teaching Hospital Parklane, Enugu.
[3] Department Of Paediatrics, University of Nigeria Teaching Hospital Ituku-Ozalla, Enugu.

Correspondence: Chiesonu Dymphna Nzeduba
Children Emergency Room (CHER), Department of Paediatrics, Enugu State University Teaching Hospital Parklane, G. R. A. Enugu

Abstract

Background:
Hypoglycemia is a serious complication in children and is associated with increased risks of morbidity and mortality. While most studies focus on neonates, limited data exist on its prevalence and clinical correlates among older pediatric populations in Nigeria.

Objective:
To determine the prevalence of hypoglycemia and identify associated clinical conditions among children admitted to the children's emergency room of Enugu State University Teaching Hospital (ESUTH).

Methods:
This cross-sectional study was conducted over a six-month period and recruited 300 children aged one month to seventeen years admitted consecutively into the children's emergency room. Children with diabetes mellitus or prior glucose infusion within six hours before admission were excluded. Demographic and clinical data were collected, and blood glucose levels were measured at admission using a glucometer. Blood glucose was measured using a glucometer and defined as hypoglycemia (<70mg/dl), normoglycemia (70 - <140mg/dl) and hyperglycemia (>140mg/dl). Associations between hypoglycemia, presenting complaints, and outcomes were analyzed using appropriate statistical tests.

Results:
The prevalence of hypoglycemia was **4.7%**, while hyperglycemia occurred in **29%**. Hypoglycemia was significantly associated with hypoxia (OR = 4.07, 95% CI: 1.32–12.53, p = 0.015), frequent passage of watery stool (OR = 4.53, 95% CI: 1.23–16.74, p = 0.023), and vomiting (OR = 10.10, 95% CI: 1.30–78.69, p = 0.027). Hyperglycemia was significantly associated with weight loss (OR = 4.19, 95% CI: 1.67–10.53, p = 0.002), while children with fever or watery stool were less likely to develop hyperglycemia.

Conclusion:
Hypoglycemia, though less prevalent than hyperglycemia, remains an important complication in critically ill children admitted to ESUTH. Routine glucose monitoring and prompt management should be prioritized in children presenting with hypoxia, diarrheal illness, or vomiting to improve outcomes and reduce preventable mortality.

Keywords: Hypoglycemia,Hyperglycemia, Emergency, Prevalence, Enugu, Children

Introduction

Hypoglycemia in children is a well-recognized medical emergency that carries significant risks for morbidity and mortality if not promptly identified and managed. It is classically defined as a whole blood glucose concentration below 2.2 mmol/L or plasma glucose below 2.5 mmol/L, although thresholds may

vary slightly depending on age, clinical context, and guidelines.[1] In pediatric practice, hypoglycemia is of particular concern because the developing brain depends heavily on glucose as its primary energy substrate. Even brief episodes of inadequate glucose supply can lead to seizures, altered consciousness, neurological injury, and in severe cases death.[2,3]

Traditionally, research on hypoglycemia in children has focused largely on neonates, in whom transitional glucose homeostasis and feeding difficulties contribute to higher vulnerability.[1,7] The prevalence of neonatal hypoglycemia has been reported to range from 5–15% in different populations.[7,8] However, more recent studies indicate that hypoglycemia is not restricted to newborns alone but is also a clinically important complication among older infants and children with acute medical illnesses. In such populations, prevalence has been shown to vary widely from as low as 1.4% to as high as 42% depending on the case mix, underlying disease burden, nutritional status, and thresholds used to define hypoglycemia.[9,10]

In sub-Saharan Africa, hypoglycemia is frequently encountered in association with common pediatric conditions such as severe malaria, sepsis, pneumonia, diarrheal disease, and severe acute malnutrition.[4,9,14] These illnesses increase the risk of hypoglycemia through multiple mechanisms, including reduced oral intake, prolonged fasting, impaired gluconeogenesis, and increased metabolic demands due to infection and systemic stress. Previous Nigerian studies have documented prevalence rates between 6% and 8% in pediatric emergency settings, with strong associations between hypoglycemia and poor outcomes including early mortality.[9,15] Yet despite its clinical importance, hypoglycemia is still under-recognized and under-reported in many low-resource settings, often due to limited access to bedside glucose testing and the non-specific nature of early symptoms.[6,9]

Globally, evidence also points to the significant burden of both hypoglycemia and hyperglycemia in acutely ill children. For instance, Osier et al. in Kenya reported that abnormal glucose concentrations on admission both low and high were independently associated with increased mortality in hospitalized children.[10] In high-income settings, studies from pediatric intensive care units have shown that both extremes of glycemic disturbance predict worse outcomes, including prolonged hospitalization, higher complication rates, and increased mortality.[12,18,20] This underscores that dysglycemia in childhood illness is not only a regional problem but a universal marker of critical illness severity.

Importantly, while stress hyperglycemia has received increasing attention in recent years, hypoglycemia remains the more immediately life-threatening disturbance, especially in young children with limited glycogen reserves. The clinical presentation may be subtle or easily mistaken for other conditions, ranging from irritability and lethargy to seizures and coma. Consequently, omission or delay in recognition may contribute to preventable morbidity and mortality.[5,7,12]

Despite the evident risks, there remains a paucity of data on the prevalence and clinical correlates of hypoglycemia among children beyond the neonatal period in Nigeria. Most studies have been hospital- or condition-specific, and few have examined the problem in general pediatric emergency admissions. Understanding the burden and associated clinical features is critical for guiding protocols on routine glucose monitoring, timely diagnosis, and prompt intervention in children at risk.

This study was therefore conducted to determine the prevalence of hypoglycemia and to identify its clinical correlates among children admitted into the emergency room of Enugu State University Teaching Hospital (ESUTH).

Methods

This cross-sectional study was conducted over a six-month period in the children's emergency room of ESUTH.

Children aged one month to seventeen years admitted into the emergency room were recruited consecutively for this study. Children with diabetes mellitus and those who have received glucose-containing intravenous fluid <6 hours before admission were excluded from the study.

For every child admitted, demographic data, presenting complaints, duration, and other relevant information were recorded. On admission to the emergency room, before commencement of fluid therapy, bedside blood glucose was obtained using a glucometer. Hypoglycemia was defined as a blood glucose of < 70mg/dl.

A total of 300 children were recruited for the study.

Ethical approval was obtained from the Ethics Review Committee of the institution and permission obtained from the Head, Department of Paediatrics. Written informed consent was obtained from parents/caregivers of the subjects.

Method of data analysis

Data obtained was analyzed using SPSS version 26 for windows. Descriptive statistics which include frequency and percentage were used to summarize categorical variables while means and standard deviations were obtained for continuous variables. Associations between categorical variables were done using Logistic regression. P value less than 0.05 was regarded as significant. Results were presented in tables and charts.

Results

Table 1: Demographic characteristics of the study participants

	Frequency	Percent
Age group		
<1 year	109	36.3
1 – 5 years	125	41.7
>5 years	66	22.0
Sex		
Male	163	54.3
Female	137	45.7

Table 1 shows that 41.7% of the study participants were between 1 to 5 years of age, 36.3% were less than a year old while 22% were more than five years old. The mean age and standard deviation were 3.52 ± 0.53. There were more male (54.3%) than female (45.7%) study participants.

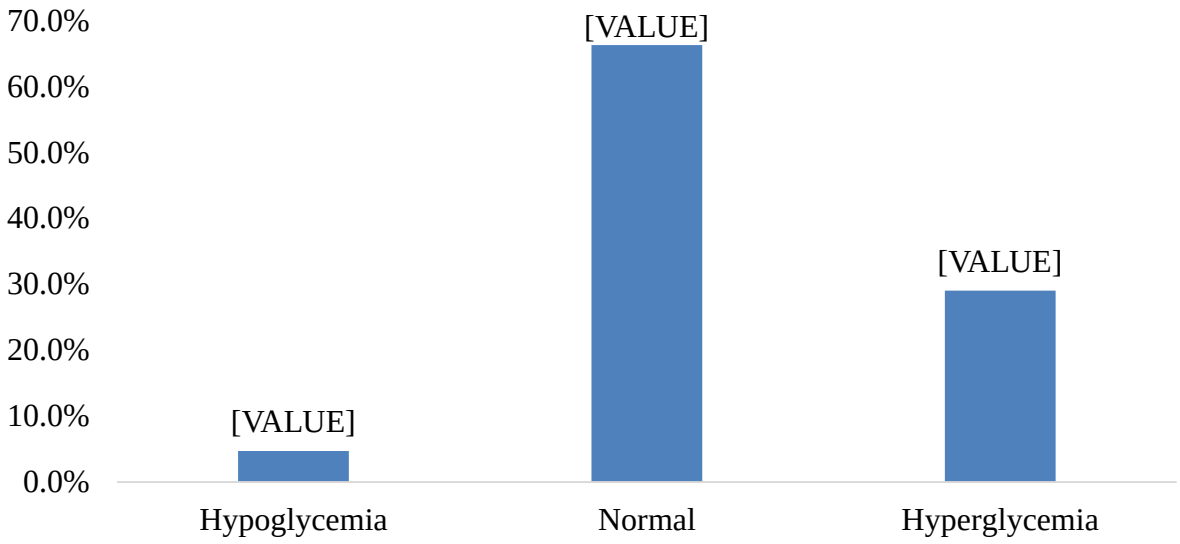

Fig 1: Prevalence of Hypoglycemia among the study participants

Figure 1 shows that the prevalence of hypoglycemia and hyperglycemia among the children are 4.7% and 29% respectively.

Table 2: Comparison of mean age of children with hypoglycemia, hyperglycemia and normal

	Hypoglycemia Mean ± SD	Normal Mean ± SD	Hyperglycemia Mean ± SD	F	P value
Age (years)	2.17 ± 0.77	3.19 ± 0.28	4.46 ± 0.13	3.055	0.049

Table 2 shows that older children (4.46) were significantly associated with hyperglycemia (F = 3.055, p = 0.049).

Table 3: Association between hypoglycemia and presenting complaints among the children

	Hypoglycemia n (%)	Normal n (%)	P value	OR	95% C.I for OR
SPO_2					
Hypoxia	6 (16.2)	31 (83.8)	0.015	4.065	1.319 – 12.528
Normal	8 (4.5)	168 (95.5)			
Consciousness					
Conscious	14 (6.7)	195 (93.3)	NA	NA	NA
Unconscious	0 (0.0)	4 (100.0)			
Respiratory					
Respiratory distress	5 (5.2)	92 (94.8)	0.448	0.646	0.209 – 1.997
Normal	9 (7.8)	107 (92.2)			
Fever					
Yes	12 (7.6)	145 (92.4)	0.303	2.234	0.484 – 10.311
No	2 (3.6)	54 (96.4)			
Frequent passage of watery stool					
Yes	11 (11.0)	89 (89.0)	0.023	4.532	1.227 – 16.743
No	3 (2.7)	110 (97.3)			
Vomiting					
Yes	13 (10.4)	112 (89.6)	0.027	10.098	1.296 – 78.689
No	1 (1.1)	87 (98.9)			
Weight loss					
Yes	1 (11.1)	8 (88.9)	0.580	1.837	0.213 – 15.821
No	13 (6.4)	191 (93.6)			
Excessive cough					
Yes	4 (6.7)	56 (93.3)	0.972	1.021	0.308 – 3.391
No	10 (6.5)	143 (93.5)			
Refusal of feeds					
Yes	2 (20.0)	8 (80.0)	0.102	3.979	0.760 – 20.837
No	12 (5.9)	191 (94.1)			

**NA = Not Applicable*

Table 3 shows that hypoglycaemia is significantly associated with hypoxia (p = 0.015, OR = 4.065, 95% C.I = 1.319 – 12.528). Children with hypoxia are 4 times more likely to have hypoglycemia than normal children. Similarly, Frequent passage of redjelly stool is significantly associated with hypoglycemia (p = 0.023, OR = 4.532, 95% C.I = 1.227 – 16.743). Children that frequently pass redjelly stool are 4 times more likely to have hypoglycemia than children that pass normal stool. Vomiting is significantly associated with hypoglycemia (p = 0.027, OR = 10.098, 95% C.I = 1.296 – 78.689). Children that vomit are 10 times more likely to have hypoglycemia than children that are not vomiting.

Table 4: Association between hyperglycemia and presenting complaints among the children

	Hyperglycemia n (%)	Normal n (%)	P value	OR	95% C.I for OR
SPO_2					
Hypoxia	15 (32.6)	31 (67.4)	0.725	1.129	0.575 – 2.218
Normal	72 (30.0)	168 (70.0)			
Consciousness					
Conscious	87 (30.9)	31 (67.4)	NA	NA	NA
Unconscious	0 (0.0)	168 (70.0)			

Respiratory					
Respiratory distress	34 (27.0)	92 (73.0)	0.263	0.746	0.447 – 1.246
Normal	53 (33.1)	107 (66.9)			
Fever					
Yes	52 (26.4)	145 (73.6)	0.029	0.553	0.326 – 0.940
No	35 (39.3)	54 (60.7)			
Frequent passage of watery stool					
Yes	23 (20.5)	89 (79.5)	0.004	0.444	0.256 – 0.772
No	64 (36.8)	110 (63.2)			
Vomiting					
Yes	49 (30.4)	112 (69.6)	0.995	1.002	0.603 – 1.664
No	38 (30.4)	87 (69.6)			
Weight loss					
Yes	13 (61.9)	8 (38.1)	0.002	4.194	1.670 – 10.532
No	74 (27.9)	191 (72.1)			
Excessive cough					
Yes	23 (70.9)	56 (70.9)	0.767	0.918	0.520 -1.619
No	64 (30.9)	143 (69.1)			
Refusal of feeds					
Yes	2 (20.0)	8 (80.0)	0.472	0.562	0.117 – 2.701
No	85 (30.8)	191 (69.2)			

**NA = Not Applicable*

Table 4 shows that hyperglycaemia is significantly associated with fever (p = 0.029, OR = 0.553, 95% C.I = 0.326 – 0.940). Children with fever are less likely to have hyperglycemia than children without fever. Similarly, Frequent passage of redjelly stool is significantly associated with hyperglycemia (p = 0.004, OR = 0.444, 95% C.I = 0.256 – 0.772). Children that pass redjelly stool are less likely to have hyperglycemia than children that pass normal stool. Weight loss is significantly associated with hyperglycemia (p = 0.002, OR = 4.194, 95% C.I = 1.670 – 10.532). Children with weight loss are 4 times more likely to hyperglycemia than normal weight children.

Table 5: Diagnosis of the study participants

Diagnosis	*N (%)*[*]
Malaria	58 (19.3)
Severe malaria	30
Acute uncomplicated	28
Multi-systemic infections	54 (18)
Sepsis	29
Severe sepsis	25
Gastroenteritis	47 (15.6)
Surgical conditions	23 (7.6)
Intussusception	12
Obstruced hernia	7
Others (intra-abdominal abscess, acute appendicitis)	4
Respiratory conditions	38(12.6)
Upper respiratory infections	19
Pneumonia	12
Pharyngotonsilitis	4
Bronchiolitis	3
Meningitis	13(4.3)
Protein energy malnutrition	13(4.3)
Renal conditions	13(4.3)

Acute glomerulonephritis, chronic kidney disease, bladder outlet obstruction secondary to PUV Nephrotic syndrome Acute renal failure	4 3 6
Complications of Paediatric HIV/AIDS	4(1.3)
Seizures Febrile convulsions Seizure disorder Status epilepticus	4(1.3) 2 1 1
Malignancies	7(2.3)
Sickle cell crises	7(2.3)
Trauma	15(5)
Poisoning	4(1.3)
Total	**300(100)**

Discussion

This study assessed the prevalence and clinical correlates of hypoglycemia among children admitted to the emergency room of Enugu State University Teaching Hospital (ESUTH). The prevalence of hypoglycemia was 4.7%, while hyperglycemia occurred in 29% of participants. These findings highlight that although hypoglycemia is less common than hyperglycemia, it remains a clinically important metabolic abnormality in acutely ill children.

Our reported prevalence of hypoglycemia aligns closely with findings from other Nigerian emergency settings: **6.4%** in a comparable cohort of 392 pediatric admissions, where hypoglycemia was strongly associated with malaria, sepsis, pneumonia, and protein-energy malnutrition and linked to increased early mortality.[10] Similarly, at the Federal Teaching Hospital Katsina, the prevalence was **6.2%**, with prolonged fasting (≥12 hours) emerging as a powerful predictor (OR = 51) and hypoglycemia significantly affecting mortality.[15]

These comparable rates emphasize that while fairly common, hypoglycemia rates vary by study setting and patient profile, but consistently show the effects metabolic derangements in acutely ill children. Our findings on associations with hypoxia, diarrheal illnesses, and vomiting support the known pathophysiology: impaired intake, increased metabolic demands, and systemic stress all contribute to glucose depletion in children. Conversely, the prevalence of hypoglycemia in this study is much lower than some studies in sub-Saharan Africa. Elusiyan et al. reported a higher prevalence of 8.3% among children in a Nigerian pediatric emergency ward, while Onyiriuka et al. found a prevalence of 7.3% among under-five children with Plasmodium falciparum malaria [4,9]. Similarly, Osier et al. documented a prevalence of 7.3% in Kenyan children admitted with various acute illnesses [10]. The lower prevalence in our study may reflect improvements in early case detection, changes in disease epidemiology, or differences in inclusion criteria and definitions used.

Consistent with earlier reports, hypoglycemia was significantly associated with vomiting, hypoxia, and diarrheal illness characterized by frequent passage of watery stools. Vomiting increases the risk of hypoglycemia by limiting oral intake and exacerbating fluid-electrolyte imbalances [2,9]. Children in our study who vomited were about ten times more likely to have hypoglycemia, emphasizing the need for glucose monitoring in such cases. Hypoxia was also a significant predictor of hypoglycemia, a finding similar to that of Wintergerst et al., who showed that metabolic dysregulation, including hypoglycemia, is more common in critically ill children with respiratory compromise [12]. Likewise, diarrheal illnesses are well recognized precipitants of hypoglycemia due to decreased intake, increased glucose utilization, and sepsis-related metabolic demands [14].

Interestingly, hyperglycemia (29%) was more prevalent than hypoglycemia. This aligns with findings from Wintergerst et al. (2006) and Kumar et al., who reported stress-induced hyperglycemia as a frequent occurrence in acutely ill children [5,12]. In our study, hyperglycemia was significantly associated with weight loss, suggesting that children with underlying malnutrition may have exaggerated counter-regulatory stress responses. Conversely, children with fever or diarrheal illness were less likely to develop hyperglycemia. This contrasts with reports by Osier et al. and White et al, who documented hyperglycemia

as a common finding in malaria and sepsis [10,11,17,18,19]. The differences may be due to variations in study populations, disease spectrum, and thresholds for defining hyperglycemia.

The age distribution of metabolic abnormalities is also noteworthy. Children with hyperglycemia were significantly older than those with hypoglycemia or normal glucose levels. This suggests that while neonates and infants remain vulnerable to hypoglycemia, older children may mount stronger stress responses leading to hyperglycemia. These findings support the argument by Cornblath and Schwartz that hypoglycemia should not be regarded as a neonatal-specific problem but rather a broader pediatric emergency [8].

The clinical implications of these findings are significant. Failure to promptly recognize and treat hypoglycemia may result in severe complications such as seizures, altered consciousness, and long-term neurodevelopmental deficits [1,7]. On the other hand, hyperglycemia has been linked to increased risks of morbidity, infections, and prolonged hospital stay [12]. Therefore, both extremes of glucose derangement deserve clinical attention. Routine bedside glucose monitoring for all critically ill pediatric patients, irrespective of age, should be institutionalized as part of emergency care in resource-limited settings.

Limitations

This study had some limitations. The cross-sectional design limited the ability to establish causal relationships between hypoglycemia and presenting complaints. Additionally, blood glucose was measured only at admission; serial monitoring would have provided better insights into fluctuations during hospitalization. The study also excluded children who received glucose prior to admission, which may have underestimated the true prevalence.

Conclusion

This study demonstrates that hypoglycemia, though less prevalent than hyperglycemia, remains an important complication in children admitted to ESUTH. Vomiting, hypoxia, and diarrheal illnesses were strong predictors of hypoglycemia, while weight loss was associated with hyperglycemia. Early recognition through routine glucose monitoring and prompt management are essential to improving outcomes and reducing preventable mortality.

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