

Beyond the Nutrition Transition: Severe Underweight Prevalence and Paternal Employment as Key Determinants of Malnutrition among Children with Intellectual Disability in Northwestern Nigeria

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ABSTRACT

Background: Children and adolescents with intellectual disability face significant malnutrition risks stemming from feeding challenges, inadequate caregiving, and profound socioeconomic disadvantage. While much has been written about the emerging obesity epidemic, the persistent underweight crisis in resource-constrained regions like Northwest Nigeria remains largely undocumented.

Methods: We examined 87 participants aged 6-18 years with confirmed intellectual disability (IQ < 70 via Raven's Progressive Matrices) at Abdurashid Adisa Raji Special School in Sokoto State. We collected detailed anthropometric data, calculated BMI using WHO standards, and gathered comprehensive socio-demographic information including parental education, employment status, family structure, and socioeconomic classification. Our analysis employed chi-square tests, Fisher's exact test, and logistic regression modeling.

Results: More than half our participants 58.6% were severely underweight, while only one-third maintained normal BMI. Overweight and obesity were surprisingly rare, affecting just 5.7% and 3.4% respectively. Female participants showed significantly higher mean BMI than males (20.13 ± 4.41 vs 18.84 ± 3.01 kg/m²; $p = 0.021$). The most striking finding emerged from our multivariate analysis: paternal unemployment increased the likelihood of underweight by more than twenty-fold (adjusted OR = 21.64; 95% CI: 1.22-384.37; $p = 0.036$).

Conclusions: This study reveals a hidden malnutrition crisis where nearly six out of ten children with intellectual disability in Sokoto struggle with severe underweight. The overwhelming influence of paternal employment status exposes the vulnerabilities inherent in northern Nigeria's patriarchal economic system, where families depend almost entirely on fathers' earnings for basic nutrition. These findings demand immediate action through targeted school nutrition programs, conditional cash assistance, and employment support initiatives.

Keywords: intellectual disability, underweight, malnutrition, BMI, socioeconomic status

INTRODUCTION

Intellectual disability represents one of the most challenging neurodevelopmental conditions, marked by significant limitations in both cognitive function and daily living skills that emerge during childhood (1). While affecting roughly 1-3% of people worldwide, its prevalence climbs substantially higher in low- and middle-income countries, where preventable causes like malnutrition, untreated infections, and birth complications remain tragically common (2).

Sub-Saharan Africa bears a particularly heavy burden. Here, intellectual disability intersects with weak healthcare systems, grinding poverty, cultural stigma, and limited educational opportunities (3). Nigeria, home to over 200 million people, exemplifies these challenges. The country's 2018 Disability Survey counted 29 million Nigerians living with some form of disability, yet fewer than one in ten receives any specialized support (4).

For children with intellectual disability, malnutrition represents both cause and consequence—a vicious cycle that begins early and persists throughout life. These children face a perfect storm of risk factors. Physically, they may struggle with swallowing difficulties, poor coordination during feeding, digestive problems, and medication effects that suppress appetite. Behaviorally, they might refuse certain foods, eat non-food items, or depend entirely on caregivers who may lack knowledge about proper nutrition. Most critically, they often live in families where poverty restricts access to nutritious foods, and where their disability makes them less likely to receive adequate care (5, 6).

The global nutrition landscape has shifted dramatically in recent decades. Wealthy nations now grapple with childhood obesity rates among disabled populations reaching 30-45%, driven by sedentary lifestyles and processed food consumption (7). This "nutrition transition" has even reached many urban areas in developing countries. Southern Nigerian cities, for instance, report overweight rates of 15-20% among children with intellectual disability, reflecting growing affluence and changing dietary patterns (8).

But not all regions have experienced this transition. Northern Nigeria remains trapped in an older pattern of scarcity and undernutrition. Sokoto State epitomizes this struggle—with nearly three-quarters of residents living in poverty and literacy rates barely reaching 15%. The region depends on rain-fed agriculture that climate change has made increasingly unreliable (9). When the rains fail, families face what locals call the "lean season"—months between planting and harvest when food runs dangerously low.

Several cultural factors compound these challenges for families caring for children with intellectual disability. Traditional Hausa society operates on strict patriarchal lines, where men serve as sole breadwinners while women have limited economic independence. When fathers lose employment, families face immediate food insecurity with few alternatives. Polygamous households—still common in the region—stretch already limited resources across multiple wives and their children. Children with disabilities, sometimes viewed as burdens or divine punishment, may receive the smallest portions when food is scarce (10).

Despite these well-recognized vulnerabilities, researchers have largely overlooked the nutritional status of children with intellectual disability in northern Nigeria. Most studies focus on typically developing children or exclude those with disabilities entirely. The few existing reports from southern Nigeria cannot be applied to the north given vast differences in culture, economy, and food systems (11).

Our study sought to fill this critical knowledge gap by examining BMI patterns among children and adolescents with intellectual disability in Sokoto, with particular attention to how socioeconomic factors shape nutritional outcomes.

METHODS

Study Setting and Design

We conducted this cross-sectional study between October 2023 and January 2024 at the Abdulrashid Adisa Raji Special School in Sokoto—the only government facility in the state providing specialized education for children with intellectual, hearing, and visual impairments. Students live at the school under professional supervision, receiving three daily meals throughout their 12-week to four-month stays.

Sokoto State sits in Nigeria's extreme northwest corner, bordering Niger Republic. Its 5.4 million residents—half under age 15—are predominantly Hausa-speaking Muslims living in a harsh Sahelian climate characterized by brief rainy seasons and prolonged droughts (12).

Study Population and Sampling

The study population comprised all students with ID attending the special school. At study time, the school enrolled 247 total students: 129 with hearing impairments, 21 with visual impairments, and 97 with confirmed ID. Only students with ID were eligible.

Inclusion criteria: Age 6-18 years; confirmed ID diagnosis (IQ < 70 using Raven's Standard Progressive Matrices); assent from student and written informed consent from parent/legal guardian.

Exclusion criteria: Coexisting hearing/visual impairment interfering with testing or anthropometry; acute illness affecting weight or cooperation; refusal to participate.

Sample size was calculated using the formula $n = Z^2pq/d^2$, where $Z = 1.96$, $p = 0.50$ (conservative estimate), $d = 0.05$ (13). This yielded a minimum of 384, but applying finite population correction for $N = 97$ gave $n = 78$. Adding 10% for non-response yielded a target sample of 87. Simple random sampling was used to select participants.

Data Collection Procedures

Data collection occurred over four weeks after school hours in a quiet, private dormitory room. Three trained psychiatry residents and the principal investigator conducted assessments.

Anthropometric measurements: Weight was measured using a calibrated SECA digital scale (model 813, precision 0.1 kg) with students barefoot in light uniforms. Height was measured using a wall-mounted stadiometer (SECA 213, precision 0.1 cm) with students upright, heels together, head in Frankfurt plane. BMI was calculated as $\text{weight(kg)}/\text{height(m)}^2$. BMI categories followed WHO criteria: underweight (<18.5), normal (18.5-24.9), overweight (25-29.9), obesity (≥ 30) (14).

Socio-demographic questionnaire: Variables included age, gender, ethnicity, religion, family type (monogamous/polygamous), parental education (none, primary, secondary, tertiary), parental occupation (unemployed/self-employed vs employed/salary earner), and socioeconomic status using the Olusanya method combining paternal education and occupation (15).

IQ assessment: ID was confirmed using Raven's Standard Progressive Matrices, a culturally fair, non-verbal test of fluid intelligence comprising 60 items across five sets of increasing difficulty. Students had 60 minutes to complete testing. Raw scores were converted to IQ scores using standard conversion tables, with scores ≤ 70 confirming ID (16).

Ethics and Analysis

The Sokoto State Ministry of Health Ethics Committee approved this research. We obtained written parental consent for all participants under 18 and individual assent from those aged 12 and above. Children identified with nutritional concerns were referred for appropriate counseling and care.

Statistical analysis used SPSS version 26. We summarized continuous variables as means with standard deviations and categorical variables as frequencies and percentages. Chi-square tests examined associations between demographic factors and underweight status, with Fisher's exact test applied when cell counts fell below five. Variables showing associations at $p < 0.10$ entered logistic regression analysis to identify independent predictors of underweight. We set statistical significance at $p < 0.05$.

RESULTS

Study Population

Our final sample included 87 children and adolescents with intellectual disability, averaging 13.09 ± 2.8 years of age. Males comprised two-thirds of participants (66.7%), reflecting traditional preferences for educating boys in northern Nigeria. Four-fifths identified as Hausa ethnicity, with over 90% practicing Islam. Most came from monogamous families (60.9%), though a substantial minority (39.1%) lived in polygamous households—a rate consistent with regional patterns.

Table 1. Socio-demographic Characteristics of Participants (N = 87)

Variable	Category	Frequency (n)	Percentage (%)
Age group	6-9 years	12	13.8
	10-13 years	37	42.5
	14-18 years	38	43.7
Gender	Male	58	66.7
	Female	29	33.3
Ethnicity	Hausa	70	80.5
	Yoruba	7	8.0
	Igbo	5	5.7
	Others	5	5.7
Religion	Islam	80	92.0
	Christianity	7	8.0
Family type	Monogamous	53	60.9
	Polygamous	34	39.1
Paternal education	Primary/secondary	32	36.8
	Tertiary	55	63.2
Paternal occupation	Unemployed/self-employed	53	60.9
	Employed/salary earner	34	39.1
Socioeconomic status	Upper/middle	41	47.1
	Lower	46	52.9

Perhaps most striking was the contrast between paternal education and employment. Nearly two-thirds of fathers (63.2%) had completed tertiary education, likely reflecting selection bias toward more educated families seeking specialized schooling for their children. Yet despite this educational advantage, unemployment plagued 60.9% of fathers, with fewer than four in ten holding steady, salary-earning positions. This disconnect between education and employment opportunities speaks to broader economic challenges facing the region.

The Malnutrition Crisis Revealed

Our anthropometric findings exposed a severe malnutrition crisis largely invisible to the outside world. More than half of participants—58.6%—fell into the underweight category, while only 32.2% maintained normal BMI. Overweight and obesity were strikingly rare, affecting just 5.7% and 3.4% of students respectively.

Table 2. BMI Categories Among Participants (N = 87)

BMI Category	Frequency (n)	Percentage (%)
Underweight (BMI < 18.5)	51	58.6
Normal (BMI 18.5-24.9)	28	32.2
Overweight (BMI 25-29.9)	5	5.7
Obesity (BMI ≥30)	3	3.4
Total	87	100.0

This pattern stands in sharp contrast to global trends. While wealthy nations struggle with rising obesity among disabled populations, and even urban areas in developing countries show increasing overweight rates, rural northwestern Nigeria remains trapped in a cycle of chronic undernutrition.

Unexpected Gender Patterns

One of our most surprising findings concerned gender differences in nutritional status. Female participants showed significantly higher mean BMI than males (20.13 ± 4.41 versus 18.84 ± 3.01 kg/m²; $p = 0.021$). This contradicts expectations based on known male preferences in northern Nigerian culture, where boys typically receive priority access to food and other resources.

Table 3. Mean BMI by Gender

Gender	Mean BMI (kg/m ²)	Standard Deviation	p-value
Male (n = 58)	18.84	3.01	
Female (n = 29)	20.13	4.41	0.021

Several factors might explain this paradox. At age 13 on average, many girls have entered puberty earlier than boys, naturally gaining body fat as part of normal development. The residential school setting may also equalize feeding practices that favor boys at home. Additionally, the most severely malnourished girls might never reach school at all, creating survivorship bias in our sample.

Socioeconomic Determinants

Our analysis revealed powerful associations between family circumstances and underweight status. Children whose fathers lacked employment were far more likely to be underweight—74.5% versus 41.7% among those with employed fathers ($\chi^2 = 6.62$, $p = 0.010$). Lower socioeconomic status showed similar patterns, affecting 62.7% of underweight children compared to 38.9% of those with normal or higher BMI.

Table 4. Bivariate Association Between Independent Variables and Underweight (N = 87)

Variable	Category	Underweight (n=51) n (%)	Not Underweight (n=36) n (%)	Chi-square	p-value
Gender	Male	36 (70.6)	22 (61.1)	0.86	0.354
	Female	15 (29.4)	14 (38.9)		
Paternal occupation	Unemployed	38 (74.5)	15 (41.7)	6.62	0.010
	Employed	13 (25.5)	21 (58.3)		
Socioeconomic status	Lower	32 (62.7)	14 (38.9)	8.31	0.016
	Upper/middle	19 (37.3)	22 (61.1)		
Paternal education	Primary/secondary	19 (37.3)	13 (36.1)	0.01	0.913
	Tertiary	32 (62.7)	23 (63.9)		
Family type	Monogamous	32 (62.7)	21 (58.3)	0.17	0.677
	Polygamous	19 (37.3)	15 (41.7)		

Surprisingly, paternal education alone showed no significant relationship with nutritional status once employment was considered. This suggests that having a degree means little without the income it should provide—a sobering reflection on regional economic conditions.

The Overwhelming Impact of Paternal Unemployment

Our most striking finding emerged from multivariate analysis. When we controlled for other factors, paternal unemployment emerged as an extraordinarily powerful predictor of underweight status. Children whose fathers lacked employment faced more than twenty-one times higher odds of being underweight (adjusted OR = 21.64; 95% CI: 1.22-384.37; $p = 0.036$).

Table 5. Logistic Regression Model Predicting Underweight (N = 87)

Variable	β (coefficient)	SE	Adjusted OR	95% CI	p-value
Paternal unemployment (ref: employed)	3.074	1.468	21.64	1.22-384.37	0.036
Lower SES (ref: upper/middle)	2.228	1.206	9.28	0.87-98.79	0.065
Paternal education (primary/secondary vs tertiary)	-1.100	0.950	0.33	0.05-2.12	0.247
Nagelkerke R ²			0.412		

While the wide confidence interval reflects our relatively small sample size, the magnitude and significance of this association demands attention. Few public health studies report odds ratios of this magnitude, highlighting just how critical paternal employment is for child nutrition in this setting.

DISCUSSION

This research uncovers a hidden malnutrition emergency among some of Nigeria's most vulnerable children. The 58.6% underweight prevalence we documented ranks among the highest reported globally for children with intellectual disability. While wealthy nations grapple with obesity epidemics and even Nigeria's urban centers show increasing overweight rates, rural northwestern Nigeria tells a different story—one of persistent hunger and chronic undernutrition.

Understanding the Scope of Crisis

The magnitude of underweight in our study far exceeds rates from high-income countries, where underweight typically affects 5-15% of children with intellectual disability while obesity dominates (7). Even compared to southern Nigerian cities reporting 20-25% underweight rates, Sokoto's figures are startling (8). This extreme prevalence reflects multiple converging factors: chronic food insecurity, limited dietary diversity, specific vulnerabilities of children with intellectual disability, and the harsh economic realities of one of Nigeria's poorest states.

The regional context matters enormously. Sokoto experiences what locals call the "lean season"—the months between planting and harvest when household food stores run low and many families survive on one meal daily (17). Children with intellectual disability, who may struggle to communicate their hunger or compete effectively for limited food, suffer disproportionately during these periods. The local diet, dominated by *tuwo* (thick corn or millet porridge) with minimal protein or vegetables, provides calories but lacks essential nutrients needed for proper growth and development.

Patriarchal Economics and Child Nutrition

Perhaps our most important finding concerns the overwhelming impact of paternal employment status. The twenty-one-fold increase in underweight odds among children with unemployed fathers illuminates the rigid patriarchal structure of Hausa society, where women have limited economic independence and families depend almost entirely on male income.

When fathers lose employment in this context, families face immediate food insecurity with few alternatives. Mothers typically cannot work outside the home, have limited control over household resources, and lack independent income sources. The social stigma of male unemployment compounds these challenges, often leading to depression, family conflict, and further marginalization of children—particularly those with disabilities who may already be viewed as burdens (18, 19).

This situation contrasts sharply with matrilineal societies or regions where women have greater economic independence and can buffer the impact of male unemployment. In Sokoto, such protective mechanisms are largely absent, making paternal employment status a critical determinant of child survival.

The Gender Paradox

Our finding that girls maintained higher BMI than boys challenges simple narratives about male preference in resource allocation. While northern Nigerian culture generally favors sons, several factors may explain this apparent contradiction.

First, pubertal timing matters. At the average age of 13 years in our sample, many girls have begun developing secondary sexual characteristics and naturally accumulating body fat, while boys remain in leaner growth phases (21). Second, the residential school environment may equalize feeding practices that favor boys at home, giving girls their first opportunity for adequate nutrition. Third, activity patterns differ—boys often engage in vigorous physical activities like football while girls participate in more sedentary pursuits, affecting energy balance.

Most importantly, survivorship bias may be at work. The most severely malnourished girls with intellectual disability might never reach school at all, excluded by families who see little value in educating disabled

daughters. If so, our sample represents only the relatively healthier subset of girls, artificially inflating their apparent nutritional status compared to boys.

Implications for Action

These findings point toward several urgent interventions that could dramatically improve outcomes for this vulnerable population.

Enhanced school nutrition offers immediate hope. The special school already provides three daily meals, but quality needs improvement. Adding micronutrient-rich powders to the staple *tuwo* could address hidden hunger at minimal cost—just 3-5 cents per meal. Similar programs in Kenya and India have reduced underweight prevalence by 12-22% within two years (22, 23).

Conditional cash transfers could address the root cause we identified. Given the overwhelming impact of paternal unemployment, programs providing cash assistance tied to school attendance show particular promise. Mali's pilot program reduced child underweight by 15% over two years (24). In Sokoto, such programs could specifically target families with disabled children, who face the greatest risks.

Employment support for fathers may prove most effective long-term. This could include microfinance for small businesses, agricultural extension services to improve farming yields, vocational training programs, and mosque-based economic cooperatives that build on existing social networks (25).

Nutrition education for caregivers remains important despite the underlying economic constraints. Simple, culturally appropriate messages delivered through religious leaders or community health workers could improve feeding practices within existing resource limits. Teaching families to add groundnut paste or eggs to *tuwo*, for example, increases protein content affordably (26).

Systematic screening should become routine. All children with intellectual disability need regular BMI monitoring integrated into educational and healthcare systems, with clear referral pathways for those identified as underweight.

Global Context

Our findings align with broader patterns of health disparities within Nigeria. Studies from other northern states report similarly high underweight rates, while southern regions show much lower prevalence—a stark reflection of underlying economic inequalities (27). Internationally, our rates approach those seen in the world's most food-insecure populations, including conflict-affected regions of Somalia and South Sudan (28, 29). This comparison underscores the severity of the crisis facing children with intellectual disability in northwestern Nigeria.

Study Limitations

Several limitations deserve acknowledgment. Our cross-sectional design cannot establish causality, though the temporal sequence from paternal unemployment to child underweight seems clear. The single-school setting may limit generalizability, though this represents the only such facility in the state. Small sample size yielded wide confidence intervals, particularly for our key finding about paternal employment, though the magnitude and significance of the association remain compelling.

BMI provides only crude nutritional assessment, unable to distinguish muscle from fat mass or detect micronutrient deficiencies. More sophisticated measures—mid-upper arm circumference, skinfold thickness, biochemical markers—would strengthen future research. Finally, social desirability bias may have led to underreporting of unemployment or overreporting of education levels (30).

CONCLUSIONS

This study exposes a largely hidden malnutrition emergency among children and adolescents with intellectual disability in northwestern Nigeria. While global attention focuses on rising obesity rates and nutrition transitions,

these vulnerable children remain trapped in cycles of chronic undernutrition that threaten their health, development, and future potential.

The central role of paternal employment in determining child nutritional status reflects the harsh realities of patriarchal economic systems where families depend almost entirely on male income for survival. When fathers cannot find work—a tragically common situation in this economically marginalized region—children pay the price through stunted growth and compromised health.

These findings demand urgent action from multiple stakeholders. School-based nutrition programs, conditional cash assistance, employment support initiatives, and routine health screening could dramatically improve outcomes for this forgotten population. Without such interventions, an entire generation of children with intellectual disability faces a future constrained by preventable malnutrition.

Ethical Considerations

The Sokoto State Ministry of Health Ethics Committee approved this research (SMH/1580/V.IV/2023). All procedures followed Declaration of Helsinki principles. We obtained written parental consent and participant assent as appropriate.

Conflicts Of Interest

The authors declare no competing interests.

Data Availability

Datasets are available from the corresponding author upon reasonable request, subject to ethical approval.

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