Original Article

Prevalence and factors contributing to stunted growth in young children of Khordha district, Odisha: A cross-sectional study

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ABSTRACT

Background: Stunting, indicating chronic malnutrition in children, remains a pressing concern globally, especially in low- and middle-income countries. India, despite substantial efforts, continues to grapple with high rates of stunting, impacting child development and health outcomes. Understanding the multifaceted factors contributing to stunting is crucial for targeted interventions and policy formulation. **Methods:** This descriptive cross-sectional study was conducted in Balipatana, Khordha district, Odisha, India among 400 children. A survey employing structured questionnaires and WHO Anthropometric guidelines for data collection was used. Statistical analyses including Chi-square tests and logistic regression models were used to uncover significant associations. **Results:** The study revealed a stunting prevalence of 28% among children under five, with 7% severe and 21% moderate stunting. Regression analysis revealed key risk factors included low birth weight (1.5–2.5 kg), parental illiteracy, lower household income (Rs. 1000–15000), inadequate toilet facilities, and specific drinking water sources. **Conclusion:** The findings align with global concerns about stunting, emphasizing the complex interplay of socioeconomic and environmental factors. Interventions targeting parental education, household economic status, and improving sanitation and drinking water facilities are imperative. By addressing these factors, focused efforts can be made to reduce childhood stunting, ensuring a healthier future for the nation's children.

Keywords: Children, India, malnutrition, Odisha, stunting

Introduction

Inadequate nutritional status of children is a significant public health problem in low- and middle-income countries worldwide. Demographic Health Surveys 2020 suggested that rates of stunting among South Asia children aged 24–59 months were higher than those aged 0–23 months. South Asia continues to be the global hub for child undernutrition, with 32.7% of children still stunted in 2018.[1] Out of the total world's underweight children, 80% live in 20 countries, including India. In India, 32.1% of children have been reported to be underweight and 35.5% of children are stunted as per the latest National Family Health Survey.[2] The government of India has firmly committed to reaching the 2030 Sustainable Development Goals (SDGs), which include ending hunger, achieving food security, improving nutrition, and promoting sustainable agriculture; all these nutritional-related factors are included in SDGs. If undernutrition cannot productively be reduced, the country will not meet its SDG target of child mortality reduction in 2030.[3]

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The burden of malnutrition varies substantially across urban and rural areas and in different states of the country. Odisha is amongst the states which bear a high burden of malnutrition with 31% of under-five children being stunted, while 29.7% of children are underweight.[4] Stunted children have been found to have behavior changes in early childhood, such as insensitivity, poor coping skills, and low emotional intelligence.[5-7] Children hospitalized for severe malnutrition in early childhood have been reported to have problems with fewer social relationships at school age, aggressive behavior, and attention deficits.[8] Undernutrition (stunting) in children was one of the causes of the excessive rate (3.94% in 2015) of infant mortality in developing countries.[9] Odisha has the highest newborn mortality rate in the country at 32 per 1000 live births, whereas the infant mortality rate in Odisha is 36.3 per 1000 live births.[4] Stunting is an outcome of various factors resulting from adverse social and economic situations such as difficulties in obtaining food, unemployment that identifies an irregular form of income for the family, limited access to education and health services, or illness caused by illness unhygienic conditions.[10-12] It also includes unpleasant circumstances and unequal access and allocation of resources among the family members.

Odisha is a state with a rich cultural heritage, yet it is nevertheless economically disadvantaged and has high rates of poverty, malnutrition, and poor health.[13] Given this unique sociodemographic context of Odisha, our study warrants a targeted investigation to understand localized factors contributing to malnutrition. This study aimed to determine the prevalence of stunting and to identify factors associated with stunting in children below five years in Balipatna Block, of Khordha, District, Odisha, India. The results of this study will have implications for local families, informed treatment strategies, and evidence-based decision-making on child growth failure in Odisha. Additionally, NGOs can create development projects and researchers can benefit from academic insights for future public health research in this field. Besides, the study's findings will give primary care physicians crucial insights into the incidence and risk factors of childhood stunting, allowing them to identify at-risk populations and tailored prevention treatments. It will also provide evidence-based recommendations for nutritional counselling and community health initiatives, boosting their ability to address this critical public health issue through both direct medical care and broader socioeconomic measures.

Methodology

Study area

The study was conducted in Balipatana, a village in the Khordha district of Odisha, India. According to the 2011 census, the total population of Khordha district in Odisha in 2011 was 2,251,673 out of which 51.84% population of lives in rural areas of villages. The literacy rate in rural areas was 82.95%.[14]

Study setting

The research focused on a rural area within the Khordha district, specifically in Balipatana. The study participants were children under five years of age.

Study design

A descriptive cross-sectional study design was employed for this research.

Study duration

Data collection occurred between March and July 2021 (Five months).

Sample size estimation

A sample size of 380 was determined using the formula: $n = Z (1 - \alpha/2)^2 P (1 - P)/d^2$, where n represents the sample size, Z is the critical value for a 95% confidence interval (1.96), P is the prevalence (45%), and d is the precision (0.05).

Sampling procedure

Balipatna block was divided into five clusters, from which four villages were selected in each cluster. Through snowball sampling and guidance from Aanganwadi workers, 20 children under five were chosen from each village, forming a sample size of 400.

Interview tools/survey instruments

Structured questionnaires were administered to mothers of the children, encompassing socioeconomic, demographic, nutritional, environmental, psychosocial, and pregnancy-related information. Anthropometric measurements (height and weight) were taken and classified according to WHO standards. Stunting was identified if a child's height-for-age Z score was less than -2 SD.[15]

Data collection technique

Mothers or caregivers were interviewed, and anthropometric measurements were taken from the children. Height measurements for infants aged 6–23 months were taken in a recumbent position, while those aged 24–59 months were measured standing—weight measurements utilizing both electronic digital weight scales and combined mother–child weights. Data were recorded in the Open Data Kit (ODK) software ensuring simultaneous data cleaning to maintain accuracy by the lead author.

Data analysis plan

Data analysis was conducted using SPSS statistical software (version 15). Descriptive statistics were employed, and Chi-square tests identified associated risk factors. Regression analyses explored causal relationships. Logistic regression models were applied to assess stunting, considering P values <0.05 as significant.

Ethical considerations

This study received ethical clearance from Institutional Ethical Review Committee (ERC/No.: 2021-15). Prior written informed consent was also obtained from the study participants ensuring confidentiality of their personal information and safety of their well-being.

Results

Out of the 240 male children, 5.4% were severely stunted, indicating acute malnutrition, while 18.8% exhibited moderate stunting. Notably, 75.8% of male children had average growth. Among the 160 female children, 55.18% suffered severe stunting, a more alarming rate compared to males. Additionally, 45.78% of female children experienced moderate stunting, underlining the severity of the issue among this demographic [see Figure 1].

The study found a diverse age and gender distribution, with a significant focus on preschool-aged children, as 30.5% of the participants were between 36 and 47 months old (60% male, 40% female). Regarding weight, most children (64%) fell within the 10.1–20 kg range, indicating an overall average weight profile, with 26% weighing between 20.1 and 30 kg. Parental education varied: 50% of fathers had secondary education or higher, 26.5% were illiterate, and 62% of mothers had education beyond the primary level. The economic status of the families was predominantly low to middle income, as 48% earned between 1000 and 15000 INR. In total, 62.8% used common tap water, emphasizing shared resources, and 80.5% had proper sanitation facilities, underlining the importance of hygiene. Birth weights were healthy (76.7% between 2.6 and 3.5 kg). Children showed average social engagement (89% made eye contact). These insights offer a comprehensive view of the participants' demographics [see Table 1].

The study reveals significant associations between stunting and various factors. Notably, children aged 0–11 months showed a higher prevalence of stunting (51.4%) compared to those aged 24–35 months (34.4%), primarily due to low birth weight.
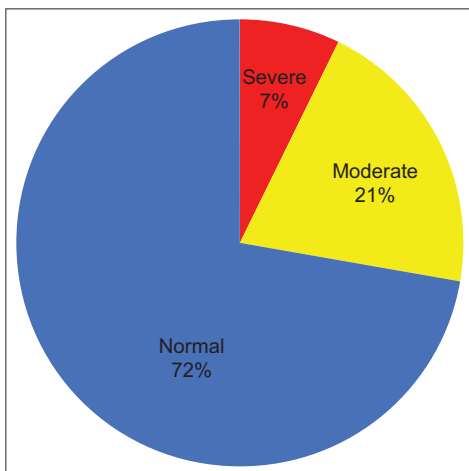
Figure 1: Prevalence of stunting among under-five children

Children with parents lacking formal education, particularly mothers, experienced higher rates of stunting. Additionally, households with lower incomes (Rs. 1000–15000) had a 23.7% higher stunting prevalence than middle-income families (Rs. 15000–30000), indicating economic influence on nutritional status. Low birth weight (1.5–2.5 kg) significantly correlated with increased stunting (30%) compared to children with average birth weight (3.6–4.5 kg, 17.4%). Furthermore, children in families with educated fathers (secondary level or higher) were 10% less likely to be stunted, whereas those with illiterate fathers faced an 18.9% higher risk. Factors such as toilet availability, drinking water source, and child responsiveness also played roles in stunting prevalence, highlighting the multifaceted nature of this issue. These findings emphasize the intricate interplay of

Table 1: Distribution of children under-five years by background characteristics	
Characteristics	**Frequency (Percentage) *n*=400 (100%)**
Age of the children (in months)	
0–11	35 (8.8%)
12–23	56 (14%)
24–35	96 (24%)
36–47	122 (30.5%)
48–59	91 (23.3%)
Gender	
Male	240 (60%)
Female	160 (40%)
Weight of the children (in kg)	
1–10	40 (10%)
10.1–20	256 (64%)
20.1–30	104 (26%)
The educational level of the father	
Secondary or more	200 (50%)
Primary	94 (23.5%)
Illiterate	106 (26.5%)
The educational level of the mother	
Secondary or more	249 (62%)
Primary	117 (30%)
Illiterate	34 (8%)
Family income	
1000–15000	192 (48%)
15000–30000	185 (46.5%)
30000–45000	23 (5.5%)
Drinking water	
Tap in house	128 (32%)
Common tape	251 (62.8%)
Hand pump	21 (5.2%)
Toilet	
Yes	322 (80.5%)
No	78 (19.5%)
Birth weight (kg)	
1.5–2.5	70 (17.5%)
2.6–3.5	307 (76.7%)
3.6–4.5	23 (5.8%)
The child looks at you when you talk to him	
Yes	356 (89%)
No	44 (11%)

socioeconomic and health factors in childhood malnutrition [see Table 2].

Children aged 11.1–23 months were 1.41 times more likely to be stunted than those aged 0–11 months ($P = 0.034$). Fathers with illiteracy had 1.48 times higher odds of having stunted children compared to those with secondary or higher education ($P = 0.022$). Additionally, children with birth weights between 1.5 and 2.5 kg had 1.53 times higher odds of stunting ($P = 0.043$). Other risk factors included the weight group of children, household income, source of drinking water, and toilet facilities ($P < 0.05$). Notably, children from families earning between 1000 and 15000 INR had 2.54 times higher odds of stunting ($P = 0.003$), emphasizing the economic impact on child malnutrition. Our study underscores the critical role of these factors in understanding and addressing childhood stunting [see Table 3].

The model's adequacy was evaluated using pseudo-R-square values, indicating that the independent variables explain between 17.0 and 24.5% of the variation in stunting. The logistic regression equation to predict stunting incorporates key factors: household income, birth weight, age of the children, father's education, toilet facilities, weight group, and drinking water sources. The estimated coefficients reveal their impact on stunting risk. Notably, a lower household income, inadequate toilet facilities, and belonging to a specific weight group increase the likelihood of stunting. In contrast, higher birth weight and particular drinking water sources decrease this risk. These factors collectively contribute to the predictive model for childhood stunting [see Table 4].

Discussion

As in other developing countries stunting remains a significant public health problem in Khordha district, Odisha, India.

Characteristics	Stunting Height for Age Z scores (HAZ)			χ^2	P
	HAZ (<-2SD)	HAZ (>-2SD)	No stunting		
Age of children (in months)					
0–11	13 (37.1)	5 (14.3)	17 (48.6)		
12–23	12 (21.4)	9 (16.1)	35 (62.5)	42.33	0.002
24–35	25 (26.0)	8 (8.4)	63 (65.6)		
36–47	28 (23.0)	5 (4.0)	89 (73.0)		
48–59	4 (4.4)	3 (3.3)	84 (93.3)		
Weight of the children (in kg)					
1–10	16 (40.0)	7 (17.5)	17 (42.5)		
10.1–20	61 (23.8)	21 (8.2)	174 (68.0)	45.82	0.002
20.1–30	5 (5.4)	2 (0.9)	97 (93.2)		
The education level of the father					
Secondary or more	15 (7.5)	5 (2.5)	180 (90)		0.040
Primary	20 (21.1)	10 (10.6)	64 (68.1)	8.66	
Illiterate	13 (12.3)	7 (6.6)	86 (81.1)		
The educational level of the mother					
Secondary or more	20 (8.0)	9 (3.6)	220 (88.4)		
Primary	15 (13.0)	35 (30.0)	67 (57.0)	4.78	0.310
Illiterate	11 (32.0)	22 (65.0)	1 (3.0)		
Household income					
30000–45000	5 (41.7)	11 (0.0)	7 (58.3)		
15000–30000	15 (7.8)	13 (4.2)	157 (88)	8.78	0.012
1000–15000	39 (16.0)	29 (7.7)	124 (76.3)		
Toilet					
Yes	26 (8.0)	10 (3.0)	286 (89.0)	7.03	0.030
No	44 (56.5)	32 (41.0)	2 (2.5)		
Drinking water					
Tap in house	35 (27.3)	8 (6.3)	85 (66.4)		
Common tape	44 (17.5)	15 (6.0)	192 (76.5)	21.75	0.001
Hand pump	4 (15.0)	6 (30.0)	11 (55.0)		
The child looks at you when you talk to him					
Yes	75 (20.8)	21 (5.9)	260 (73.3)	8.78	0.234
No	8 (18.2)	8 (18.2)	28 (63.4)		
Birth weight					
3.6–4.5	2 (8.7)	2 (8.7)	19 (82.6)	3.14	0.0435
2.6–3.5	67 (21.5)	20 (6.5)	220 (72.0)		
1.5–2.5	14 (20.0)	7 (10.0)	49 (70.0)		

Despite various interventions such as the National Food Security Act 2013, Integrated Child Development Services, Midday Meal Scheme, and Indira Gandhi Matritva Sahyog Yojna, the prevalence of stunting among children under five years of age in Khordha district among under-five children was 28% with 7% having severe stunting and 21% having moderate stunting. Our findings show that risk factors for stunting in children under five years of age are inversely associated with birth weight.

Table 3: Logistic regression of stunted children for different characteristics

Characteristics	OR	95% C.I. for OR		P
		Lower	Upper	
Age of the children (in months)				
0–11(Ref)				
11.1–23	1.41	0.10	2.22	0.034
23.1–35	1.37	0.13	1.77	0.027
35.1–47	1.48	0.11	1.27	0.011
47.1–59	1.46	0.14	1.49	0.019
The educational level of the father				
Secondary or more (Ref)				
Primary	1.41	0.22	0.82	0.011
Illiterate	1.48	0.19	0.88	0.022
Weight group children				
1–10 (Ref)				
10.1–20	1.62	0.91	2.21	0.002
20.1–30	1.34	0.36	1.023	0.012
Drinking water				
Tap in the house (Ref)				
Common tap	1.23	0.42	1.62	0.003
Hand pump	1.10	0.45	2.34	0.042
Toilet				
Yes (Ref)				
No	2.16	1.00	4.29	0.044
Household income				
30000–45000(Ref)				
15000–30000	1.65	1.29	3.65	0.040
1000–15000	2.54	1.98	5.36	0.003
Birth weight (in kg)				
3.6–4.5 (Ref)				
2.6–3.5	1.49	1.49	2.61	0.031
1.5–2.5	1.53	1.76	2.92	0.043

Similar studies in Maharashtra, India, found that the overall prevalence of stunting among under-five children was significantly associated to the sex of the child in the urban slum, birth order in the rural area, and types of family in the urban slum.[16,17] Our study reported that children in lower household economic status had 2.54 greater odds of being stunted than children in lower household financial status. In congruence with this, a study conducted in Nepal revealed that stunting was higher among children with low socioeconomic status.[18] Poor health can slow growth by limiting access to nutritious foods, hindering access to health care, and affecting education about proper nutrition and hygiene for children. Additionally, poor lifestyles linked to economic problems can increase the risk of infection and disease.

Parental education was significantly associated as an acritical predictor of stunting among under-five children in this study. One study in Kolar, Madhya Pradesh, revealed that certain variables like small family size, two children, higher level of parental education, good personal health, and hygiene-related factors were protective factors of stunting.[19] In our study, mothers' education level was a protective factor for stunting. Contrastingly, a study was conducted in rural and urban Haryana revealed that stunting was influenced by mother education status ($P = 0.001$) with an increased prevalence of stunting among children of illiterate mothers.[20] Low parental education can lead to inadequate knowledge of the child's nutrition, hygiene, and health care, which can lead to retarded growth. Lack of information can affect decision-making ability and affect the child's behavior and development.

The finding of our study also revealed that 28% of the children below 59 months were stunted, which is below the prevalence reported by Joint Malnutrition Estimated (30.90%) in 2020 of stunting in India for children aged 0–59 months.[15] Studies conducted in India showed that stunting prevalence is from 16.4 to 62.8% across 723 districts in India.[21]

According to the global public health recommendation, a child should be breastfed exclusively during the first six months to achieve optimum growth, development, and health. To evolve as a healthy individual, the infant should continue with adequate and appropriate safe, complimentary food and breast milk up

Table 4: The R^2 value of the model

Model	Unstandardized coefficients		Standardized Coefficients	t	<P
	B	St. Error	Beta		
Constant	1.509	0.259		5.835	
Household income	−0.058	0.041	−0.071	−1.401	0.032
Birth weight	0.040	0.045	0.041	0.877	0.002
Age of the children	0.032	0.026	0.0899	1.259	0.020
Education of father	0.052	0.041	−0.071	−1.401	0.004
Toilet facilities	−0.371	0.162	−0.108	−2.292	0.022
Source of drinking water	0.036	0.038	0.045	0.929	0.034
Psychosocial factor	−0.058	0.070	−0.041	−0.834	0.040
Weight group of the children	0.184	0.048	0.263	3.823	0.002

to 2 years of age or beyond.[17] The study findings will help to improve policy measures focusing on parental education, financial support, sanitation, and safe drinking water. Awareness campaigns regarding the long-term effects of stunting are important in raising awareness in society.

Policy implications and recommendations

For the past decade, while India's strategic focus on combating malnutrition through national programs such as Public Distribution System and the Integrated Child Development Scheme have attempted to combat food insecurity and malnutrition, inefficient food distribution and low nutritional value of disseminated foods continue to be difficulties. The launch of the POSHAN Abhiyaan in 2017 might be regarded as an important milestone in the eradication effort. Furthermore, environmental initiatives like the Swachh Bharat Abhiyan are thought to play a role in lowering stunting. Despite these efforts, the complex issue of stunting still persist. Hence, a holistic approach is required to address the issue.[22] Enhancing the availability of clean drinking water and sanitary facilities is vital, in addition to mitigating household poverty via efficient social safety networks. Additionally, throughout the prenatal and postnatal phases, parents should be provided with a tailored communication and counselling that ensures cultural sensitivity and considers the educational status of mothers. This strategy recognizes that providing parents with culturally competent care and education by primary care physicians is essential for bringing long-lasting change. Besides, ongoing evaluation and monitoring of these treatments is crucial to their performance in order to guarantee data-driven modifications.

Strengths of the study

The study stands out due to its robust design, well-defined sampling frame, participant engagement, scientific accuracy, and confidence in our findings.

Limitations of the study

Considering the cross-sectional nature of the study and the fact that study was conducted during a particular time frame prevents the establishment of temporal relationships as factors influencing the stunting prevalence such as socioeconomic and environmental conditions might change over time. Therefore, Future research should consider longitudinal methods or repeated cross sectional surveys to gain more insight into the trends and factors associated with stunting over time. Additionally, representing a larger area than Balipatana may increase the generalizability of this study.

Conclusion

The study highlights the prevalence of stunting among children aged 0–59 months. Parental education, economic status, toilet facilities, birth weight, and drinking water sources increase stunting risk. We recommend promoting informal education for women and men, addressing household food insecurity through targeted interventions, and enhancing antenatal care services during pregnancy.

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Conflicts of interest

There are no conflicts of interest.

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