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Determinant of stunting among children under-five years: A nationwide study in Zambia

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ABSTRACT

Background: Stunting cases among children represent one of the most serious issues in human development. Zambia, in particular, has a higher number of stunting cases in Africa.
Objective: The purpose of this research was to analyze the prevalence and determinant of stunting among children under-five years in Zambia.
Methods: This study utilized data from the 2018 Zambia Demographic Health Survey (ZDHS), with a total of 1,710 surveys selected. We observed variables related to mothers, children, and the environment to assess stunting. Chi-Square and Binary Logistic Regression were used for data analysis.
Results: A total of 22,16% children under five years in Zambia had a stunting. We found that factors such as low birth weight (<2500 grams) (OR = 3.24; 95% CI = 2.163-4.869), mothers with no education (OR = 1.80; 95% CI = 0.681-4.760), those with the poorest wealth index (OR = 2.30; 95% CI = 1.341-3.943), intervals between previous children less than 24 months (OR = 1.58; 95% CI = 1.107-2.270), and breastfeeding for more than 6 months (OR = 4.499; 95% CI = 3.179-6.67) were associated with a higher likelihood of stunting in Zambia.
Conclusions: Our study demonstrates that stunting is associated with family and household factors, as well as breastfeeding practices. Policymakers should consider implementing structured policies to address stunting, particularly for expectant mothers, as a long-term solution.

Keywords: stunting; growth disorder; child

INTRODUCTION

The incidence of childhood stunting is one of the most significant challenges in human development. This issue has become a global concern, particularly in relation to malnutrition and the goal set by the World Health Assembly (WHA) to reduce stunting in children under five years of age by 2025 (World Health Organization, 2018). Children who experience stunting face difficulties in achieving their maximum height and may develop cognitive developmental disorders (World Health Organization et al., 2021). Stunting is linked to underdeveloped brains with severe long-term consequences, including reduced mental abilities, limited learning capacity, decreased income,

Nursing and Healthcare Practices

- *Nurses can serve as mediators, facilitating collaboration between the healthcare sector and other sectors to collectively address the issue of stunting*
- *Nurses can also function as educators, raising public awareness and knowledge about stunting.*
- *Nurses can prioritize the family unit as the central focus in addressing stunting through family-centered care.*

and an increased risk of chronic nutrition-related diseases (UNICEF, 2020). This will undoubtedly impact the quality of the future workforce.

Globally, in 2020, stunting affected approximately 22% of children under the age of five (WHO, 2021). More than half (54%) of these children reside in Asia, while two-fifths (40%) live in Africa. In Africa, the incidence of stunting has reached high levels, with 31.5% and 34.5% in the central and western states, respectively. In the southern and eastern states, it remains high at 29% and 27.7%, and in the northern states, it is at a moderate level of 17.6% (World Health Organization et al., 2021).

Stunting is a manifestation of chronic malnutrition, indicating a prolonged period of inadequate nutrition (Central Statistical Agency [CSA] [Ethiopia] & ICF, 2016; Zambia Statistics Agency et al., 2019). One of the contributing factors to the occurrence of stunting is poor nutrition care, which includes maternal knowledge regarding health and nutrition before, during pregnancy, and after childbirth, particularly during the first 1000 days of a child's life (Ramayulis et al., 2018). Malnutrition places a significant burden on Zambia's healthcare system and results in a shortage of human resources (Zambia Statistics Agency et al., 2019). Zambia has made commitments to improve both the quality and quantity of nutrition through various programs implemented since 2006 (USAID, 2021). Between 2019 and 2026, the Zambian government launched two initiatives: the Scaling Up Nutrition Technical Assistance (SUN TA) program, aimed at accelerating Zambia's progress in improving nutrition, and the implementation of the Zambian government's Most Critical Days Program (MCDP II). This comprehensive effort focuses on enhancing nutrition-related technical expertise as needed and revolves around reducing the stunting rate by two percent annually in specific districts throughout Zambia. The collaborative project, SUN Learning and Evaluation (SUN LE), works in partnership with the Zambian government, SUN TA, and other stakeholders to assess advancements in nutrition improvement and conduct specialized research to inform best practices (USAID, 2022).

In a previous study related to socio-economic factors affecting stunting in children under five years in Zambia, the main predictors were identified as the child's sex and age, maternal age and education level, wealth index, improvement in drinking water sources, duration of breastfeeding, and place of residence (Mzumara et al., 2018). Additionally, the World Health Organization (WHO) has outlined four main factors contributing to stunting: family and household factors (including maternal factors and home environment), inadequacy factors related to complementary foods (such as poor quality food and inadequate practices), breastfeeding factors (including inadequate practices), and infection factors (comprising clinical and subclinical infections) (World Health Organization, 2014). Research conducted by Islam (2020) found that the WHO conceptual framework was valuable in identifying a wide range of factors influencing stunting during the first 1,000 days of life. This study also noted that child characteristics, including age, sex, and low birth weight and length, were associated with early childhood stunting.

In this study, we will analyze stunting factors based on the four main factors defined by the WHO. The family and household factors will encompass Low Birth Weight (LBW), mother's education, mother's age at delivery, household wealth index, antental care (ANC) examination history, place of residence, and birth distance. Additionally, we will examine complementary foods, breastfeeding practices, and infection factors. These ten selected factors have been shown to be associated with stunting based on previous research and align with the WHO framework. This research will serve as a valuable reference source and may contribute to the publication in an international journal focused on stunting. It is expected that this

publication will provide important insights to help the Government of the Republic of Zambia develop more targeted and impactful regulations aimed at reducing the incidence of stunting. The primary objective of this study is to analyze the determinants associated with the occurrence of stunting in Zambia.

METHODS

Design

The research design used is analytical research, which aims to find relationships between one variable and another.

Sample and Setting

The sample used in this research consisted of the entire study population, with the unit of analysis being children aged less than 5 years. This choice was made because the research aims to investigate the determinants influencing the incidence of stunting in Zambia. The inclusion criteria for this study were all children aged less than 5 years who exhibited stunting, defined as having a standard deviation (SD) or z-score of less than -2 Standard Deviation (-2 SD) (Zambia Statistics Agency et al., 2019).
The study identified a total of 10,094 children under 5 years of age eligible for height and weight measurements. Out of these, 95% had valid data for measuring height and age. Specifically, 9,610 children had their height and age measured, comprising 4,750 boys and 4,860 girls. From this data, it was observed that 38.3% of boys and 31.0% of girls experienced stunting.

For the 2018 Zambian Demographic and Health Survey (ZDHS), participants were selected using a two-step sampling process. In the initial sampling stage, 545 clusters, which included enumeration areas (EAs) established for the 2010 population census, were chosen. In the subsequent sampling stage, 13,625 households were systematically selected from these chosen EAs. The 2018 ZDHS collected data related to height and weight measurements.

Variable

The variable provided directly, including the date, month, and year (in numerical form) for the child's birth date and the child's body length in centimeters. Subsequently, the standard deviation was calculated from these two questions and grouped into two categories: Stunting (<-2 SD) and Non-stunting (≥ -2 SD) (Dolifah et al., 2021; Zambia Statistics Agency et al., 2019). As for the independent variables considered in this study, they included the following 1) History of low birth weight (LBW): Categorized as children with low birth weight (<2500 grams) and children with normal birth weight (≥2500 grams). 2) Mother's education: Classified into no education, primary (elementary school), secondary (junior high school - senior high school), and high (university). 3) Mother's age: Divided into <20 years and >20 years. 4) Household wealth index: Grouped into poorest, poor, middle, rich, and richest, based on the ZDHS's category definitions. 5) History of ANC examination: Categorized as <4 times and ≥4 times, in accordance with WHO recommendations and previous research advocating for at least 4 ANC examinations. 6) Place of residence: Classified as urban and rural. 7) Birth spacing: Separated into two categories: <4 times and ≥4 times, and <2 years and ≥2 years. 8) Complementary feeding: Determined based on whether other foods (e.g., cereals) were given to children and categorized as yes or no. 9) Exclusive breastfeeding: Categorized as <6 months and ≥6 months. 10) Infection (Diarrhea): Grouped as Yes (in the last 2 weeks) or No (Zambia Statistics Agency et al., 2019).

Instruments

The ZDHS 2018 utilized four questionnaires, namely household, female, male, and biomarker questionnaires. The biomarker questionnaire included anthropometric measurements. Within all households, height and weight measurements were recorded for children aged 0-59 months. Weight measurements were obtained using lightweight, electronic SECA 878 scales equipped with a digital display and a function for both mother and child. Height measurements were conducted using measuring boards manufactured by Shorr Productions. For children aged below 24 months, measurements were taken while they were lying down (recumbent) on the board, whereas standing height was measured for children aged 24 months and older. In this study, researchers employed all four questionnaires to analyze the factors influencing the incidence of stunting in Zambia, as these factors were addressed in the household, women's, men's questionnaires, and included anthropometric measurements.

Table 1. Mother and children characteristics of study participants (n = 1,710)

Variable	Stunting				X^2
	Stunting		Not stunting		
	N	%	N	%	
Birth Weight					
Not Low Birth Weight	325	20.38	1,270	79.62	43.93***
Low Birth Weight	54	46.96	61	53.04	
Education Level					
High	7	10.29	61	89.71	
Secondary	101	18.84	435	81.16	12.95**
Primary	230	24.16	722	75.84	
Never Study	41	26.62	113	73.38	
Mother's Age					
< 20 years	282	23.31	928	76.69	3.13*
> 20 years	97	19.40	403	80.60	
Wealth Quintiles					
Richest	25	10.68	209	89.32	
Richer	55	23.11	183	76.89	22.56***
Middle	76	22.09	268	77.91	
Poorer	104	23.85	332	76.15	
Poorest	119	25.98	339	74.02	
ANC History					
< 4 times	121	22.08	427	77.92	0.003*
> 4 times	258	22.20	904	77.80	
Residence					
Urban	103	20.00	412	80.0	2.00*
Rural	276	23.10	919	76.90	
Birth Interval					
>24 months	324	21.15	1.208	78.85	8.79*
<24 months	55	30.90	123	69.10	
Complementary Foods					
No	337	22.80	1.141	77.20	2.57*
Yes	42	18.10	190	81.90	
Exclusive Breast Milk					
< 6 months	41	7.90	478	92.10	87.89***
> 6 months	338	28.38	853	71.62	
Diarrhea History					
No	288	21.65	1.042	78.35	0.90*
Yes	91	23.95	289	76.05	

Note.*p<0.1; **p<0.05; and ***p<0.001

Table 2. Factors associated with stunting in Zambia

Variable	OR	95% CI	
		Lower	Upper
Low Birth Weight			
Not LBW	Ref		
LBW	3.24***	2.16	4.87
Birth Interval			
>24 months	Ref		
<24 months	1.58**	1.11	2.27
Exclusive Breast Milk			
< 6 months	Ref		
> 6 months	4.5***	3.18	6.37
Education Level			
High	Ref		
Secondary	1.4*	0.58	3.41
Primary	1.67*	0.66	4.01
No	1.80*	0.68	4.76
Wealth Quintiles			
Richest	Ref		
Richer	2.09***	1.204	3.651
Middle	1.798*	1.044	3.097
Poorer	2.084*	1.218	3.564
Poorest	2.300*	1.341	3.943

Note. Note.*p<0.1; **p<0.05; and ***p<0.001

Data Collection

This study relies on secondary data obtained from the 2018 Zambia Demographic Health Survey (ZDHS), conducted between July 18, 2018, and January 29, 2019. The dataset used for this study was extracted from the household and children's data files, with a specific focus on stunting. The data included in this research pertains to children under the age of five who were eligible for height and weight measurements.

Data Analysis

The study employed descriptive statistical methods, including frequency analysis and cross-tabulations, to analyze the characteristics of both the children and their mothers. This analysis was conducted separately for data from the female and biomarker questionnaires. The dependent variable, related to stunting, was categorized into two groups: "stunting" and "non-stunting." Subsequently, a binary logistic regression model was utilized to examine the factors associated with the stunting status. All of these analyses were performed using Stata 14.1, incorporating complex sample procedures to accommodate the survey's intricate sampling design.

Ethical Consideration

The authors of the study indicated that the survey procedure received approval and underwent scrutiny by the Institutional Review Board of ICF on October 13, 2020. Moreover, the DHS Program granted permission for the utilization of datasets derived from the Demographic and Health Surveys (DHS). The study strictly adhered to the principles outlined in the Declaration of Helsinki. Additionally, informed consent was meticulously obtained from all study participants, as well as from their respective parents or legal guardians.

RESULTS

According to the 2018 DHS data, the overall prevalence of stunted children in Zambia was 22.16% among those under the age of five. The variables examined in the study were

related to mothers and children, with specific data collected from the female and biomarker questionnaires, respectively. Those with no education, aged less than 20 years old, and who had ANC history more than four times had stunting percentages of as much as 26.62%, 23.31%, and 22.20%, respectively. Meanwhile, approximately 23.10%, 30.90%, and 25.98% of subjects living in urban areas, having birth spacing less than 2 years, and coming from low-income families tended to have stunting. Most children with a history of low birth weight had stunting (46.96%), with a history of diarrhea being the highest rate (23.95%). Children who were breastfed for more than 6 months had a stunting rate of 23.38%, while those who were not given complementary food had a rate of 28.80%.

A Chi-square test was conducted, as shown in Table 1, revealing that five independent variables had significant effects on the incidence of stunting in Zambia. These variables include low birth weight, maternal education, household wealth index, distance between births, and breastfeeding. However, five variables did not show significant results on the incidence of stunting. These variables were maternal age, ANC history, place of birth, complementary feeding, and history of diarrhea, so they were not included in the multivariate analysis.

The analysis of family and household variables yielded significant findings. Mothers with no formal education were found to be at a higher risk of having children with stunting compared to mothers with higher education levels (odds ratio [OR] = 1.801, 95% confidence interval [CI] = 0.681-4.760). This suggests an elevated risk, although the CI indicates some uncertainty in the estimate. Furthermore, mothers from the lowest wealth quintile were 2.3 times more likely to have children with stunting compared to mothers from the highest wealth quintile (OR = 2.3, CI = 1.341-3.943). These findings highlight the influence of maternal education and household wealth on the likelihood of child stunting. Those with birth spacing less than 24 months were associated with stunting (OR = 1.58, CI = 1.11-2.27). Additionally, children born with low weight were 3.2 times more likely to experience stunting compared to those with normal birth weight (OR = 3.2, CI = 2.16-4.87) (Table 2).

Regarding exclusive breastfeeding, the majority of children who were breastfed for more than 6 months were more likely to experience stunting than those who were breastfed for less than 6 months (OR = 4.5, CI = 3.18-6.37).

DISCUSSION

The prevalence of stunting in Zambia is currently at 22.16% among children under five years old. This data reflects a significant improvement compared to the results of a study that used ZDHS 2014 data, which reported a stunting incidence of 40% (Mzumara et al., 2018). This reduction can be attributed to the diligent efforts of the Zambian government through various programs aimed at tackling this issue. However, it's worth noting that this figure still exceeds the maximum tolerance limit for stunting set by the World Health Organization (WHO). WHO's maximum stunting tolerance limit is 20%, or one-fifth of all children in a country (Dolifah et al., 2021).

The study identified a significant factor associated with stunting, which is birth spacing. Those with birth intervals of less than 24 months before the next child were found to be at a higher risk of experiencing stunting compared to those with birth intervals of more than 24 months. These findings are consistent with a previous study that also concluded that children with birth intervals of less than 3 years are more likely to experience stunting when compared to children with longer birth intervals of more than 3 years. This underscores the importance of adequate birth spacing in reducing the risk of child stunting (Sumiaty et al., 2017). Therefore, proper family planning, particularly in countries with high birth rates, can play a crucial role in reducing stunting in children. Careful planning and the use of family planning methods are expected to increase the quantity and quality of child care, especially in terms of providing adequate nutrition to children, with the hope of reducing the risk of stunting (Rana & Goli, 2018).

The educational background of the mothers in this study exhibited a significant correlation with the incidence of stunting in their children. Mothers who had no formal education were found to be at a significantly higher risk of having children with stunting when compared to mothers with higher levels of education. These findings are consistent with previous studies that have also reported a positive association between a higher level of maternal education and a reduced risk of stunted growth in children. This underscores the crucial role of maternal education in mitigating the risk of stunting in children and underscores the significance of

education as a determinant of child health and development (Haque et al., 2022; Laksono et al., 2022). Education plays a pivotal role in enhancing a mother's ability and willingness to provide the best care for her child. It begins with an increase in the quality and quantity of knowledge acquired by the mother during her schooling years. This knowledge acquisition facilitates a better understanding of various aspects of pregnancy, from the prenatal to the postnatal period. The capacity to absorb and apply this knowledge increases the likelihood of mothers being well-informed about appropriate childcare practices and, consequently, better equipped to provide optimal care for their children.

In relation to the wealth quintile, this study found that children from low-income families had the highest percentage of stunting when compared to children from higher socio-economic status levels. These results are consistent with another study that demonstrated a higher incidence rate of stunting among children from poorer wealth index backgrounds as opposed to those from wealthier backgrounds. This underscores the significant influence of socio-economic status on the likelihood of child stunting and supports the notion that poverty is indeed a risk factor for stunted growth in children (Angdembe et al., 2019; Beal et al., 2018; Titaley et al., 2019). Households with a higher household wealth index tend to have more secure access to meeting their food needs and are better positioned to fulfill the nutritional requirements of their children (Agho et al., 2019; Titaley et al., 2019). The increase in the household wealth index from the poorest to the richest quintile reflects the enhanced ability to meet the family's needs, including adequate nutrition for children. This financial stability also extends to maternal care during pregnancy and the postpartum period, making it easier to access and afford the necessary healthcare and nutrition, without financial barriers hindering maternal and child well-being.

The present study highlights determinant factors related to stunting in children, with a focus on low birth weight (LBW). Children with a history of birth weight less than 2500 grams were found to be more likely to experience stunting than children born with a normal birth weight. LBW is considered a predisposing factor for post-birth growth. The 29th World Health Assembly also employed the definition of LBW as '2500 grams or less'. It's important to note that LBW can be further categorized into very low birth weight (VLBW, <1500 grams) and extremely low birth weight (ELBW, <1000 grams). LBW is associated with various long-term health implications, including neurologic disability, impaired language development, diminished academic achievement, and an increased risk of chronic diseases such as cardiovascular disease and diabetes (Cutland et al., 2017). LBW can be linked to factors like preterm labor, Intrauterine Growth Retardation (IUGR), or both (Aryastami et al., 2017; Halli et al., 2022; K C et al., 2020). Infants who experience Intrauterine Growth Restriction (IUGR) are often born undernourished and may be more susceptible to a range of health issues. These infants face a higher risk of diseases like diarrhea and lower respiratory tract infections. Additionally, they may be at an increased risk of complications, including sleep apnea, jaundice, anemia, chronic lung disorders, fatigue, and loss of appetite. IUGR can have lasting effects on the health and development of these infants, making them more vulnerable to various health challenges (Sartika et al., 2021).

According to the study's findings, children who were exclusively breastfed for more than 6 months were more likely to experience stunting than those who were exclusively breastfed for less than 6 months. The observed correlation between the duration of breastfeeding and stunting can be attributed to the delay in introducing complementary foods for infants, resulting in inadequate nutritional support for the development of children aged over 6 months (Dhami et al., 2019; Syeda et al., 2021; UNICEF, 2020). Prolonged breastfeeding, without the timely introduction of appropriate complementary foods, can lead to a child's overreliance on breast milk alone. This exclusive dependency on breast milk, without the incorporation of solid foods at the appropriate age, can potentially lead to difficulties in chewing and hinder the child's ability to transition to a more diverse diet. Consequently, this prolonged dependence on breast milk, without adequate dietary diversification, may compromise the child's immune system and impede their growth and development (Syeda et al., 2021). It is essential to adhere to recommended feeding guidelines to ensure that children receive the necessary nutrients and support for their healthy development as they grow. Proper nutrition, including the introduction of complementary foods at the appropriate stage, plays a vital role

in preventing stunting and promoting overall child health.

This research goes beyond the four factors identified by WHO as influencing the incidence of stunting and delves deeper into the underlying causes of these factors. For instance, within the category of family and household factors, the study examines inadequate sanitation and drinking water supplies. Furthermore, the research analyzes the factors contributing to inadequate sanitation and drinking water supply, particularly focusing on the household and residential wealth index, which is closely linked to water availability in terms of both quantity and quality. The analysis reveals that the wealth index significantly affects the incidence of stunting. This approach aims to provide a comprehensive understanding of the underlying causal factors contributing to stunting and offers valuable insights into addressing these root causes. By addressing these fundamental factors, such as wealth index and access to clean water, there is a greater potential for success in reducing the incidence of stunting and improving child health outcomes.

CONCLUSION

Stunting is significantly associated with family and household factors as well as breastfeeding. These factors should be carefully considered when formulating policies and programs, as exemplified in the case of Zambia, where initiatives like the Scaling Up Nutrition - Learning and Evaluation program can play a crucial role in disseminating knowledge and engaging communities. Moreover, such programs can serve as a foundation for collaboration with professional societies, including nurses. Nurses can actively contribute to enhancing the quantity and quality of community education and support at the grassroots level, enabling them to reach the entire community. This collaboration holds a long-term goal of reducing the incidence of stunting. It starts with initiatives such as increasing the education levels of women, especially expectant mothers, and raising awareness about nutrition during pregnancy and its impact on low birth weight (LBW). Additionally, it emphasizes the importance of birth spacing and timely breastfeeding. Furthermore, it aims to enhance family awareness regarding the significance of financial aspects and their connection to stunting. By addressing these factors through collaborative efforts, there is a greater likelihood of achieving sustainable improvements in child health and nutrition outcomes.

Declaration of Interest

None

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Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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