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Original Article

Why is stunting highest in Western Uganda?

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ABSTRACT

Stunted children have a high risk of death, and over 30 percent of under-5 children in Sub-Saharan Africa are affected. In Uganda, 29 percent of children under five are stunted, and this has remained high over the last decade but is worse in the Western region of the country. We used pooled Uganda Demographic and Health Survey (UDHS) data from 2001 to 2016, obtained from the *measure DHS* website, to establish factors that could explain stunting among children aged 24 to 59 months by applying a logistic regression model. Results show that children whose mothers had attained higher levels of education were significantly associated with reduced odds (0.2) of stunting compared to those with no education. Children whose mothers had not received health information were significantly associated with increased odds (1.3) of stunting. Children who had had diarrhoea two weeks before the survey were associated with higher odds (1.5) of stunting compared to those who did not have it. Male children were also significantly associated with increased odds (1.2) of stunting compared to females. Children from empowered mothers were significantly associated with reduced odds (0.7) of stunting compared to those who were not empowered. The findings call for increased education of the girl child, access to health information for mothers, prevention, prompt treatment of diarrhoea, care of the boy-child, and sensitization aimed at empowering women.

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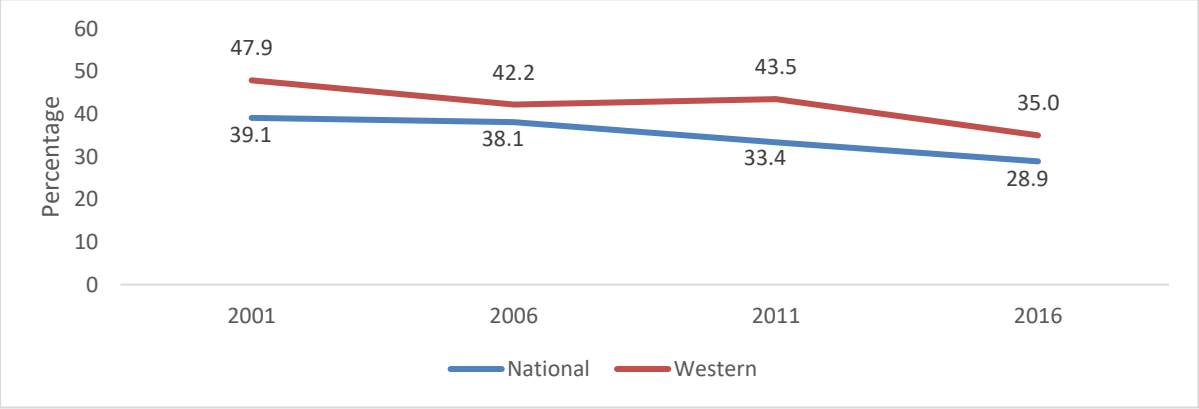
INTRODUCTION

Stunting, defined as being too short for age, has a lifetime negative effect ([Dewey & Begum, 2011]) and remains a global concern, contributing to over 35% of the deaths among children aged between 24 and 59 months (UNICEF & WHO, 2020). Stunting is an indicator of chronic undernutrition that impacts millions of children worldwide, posing a threat to their health and prospects (Quamme & Iversen, 2022). Stunting has a negative impact on cognitive and intellectual abilities, contributing to poor academic performance (Akombi et al., 2017). Subsequently, this increases the chances of living in poverty. The Global Nutrition Report of 2018 estimated that 150.8 million (22.2%) children under 5 years are stunted and 50.5 million (7.5%) are wasted (Fanzo et al., 2018). The report further notes that despite a decrease in the prevalence of stunting across the African continent from 38.3% in 2000 to 30.3% in 2018, the growing population in the region has resulted in a threefold increase in the number of stunted children. Sub-Saharan Africa (SSA) remains the region with the highest burden of stunting (Danjin et al., 2020), achieving only a 4.3% reduction between 2012 and 2019. Moreover, the region continues to account for a relatively high number of stunted children in absolute terms (UNICEF & WHO, 2020).

In Uganda, 29% of the children under 5 were classified as stunted, only a 4.5% reduction from the figure reported in the 2011 UDHS report (Uganda Bureau of Statistics (UBOS) & ICF, 2018). Additionally, significant regional variations, especially in the Western part of the country, have existed over time in the prevalence of stunted children. For example, Figure 1 shows that stunting has consistently remained higher in the Western compared to the national average over the last two decades, despite the region being considered a "food basket" for the country (Kikafunda et al., 2014). This disproportionate burden exposes children in the Western region to greater risks associated with stunting compared to their peers in the country and other parts of the world. Despite the high prevalence of stunted children in Western Uganda, there is limited documented evidence on the factors contributing to stunting in the region. A related study (10) focused solely on one of its 26 districts (UDHS data from 2016), which limited its ability to represent the Western region. This limitation justified the need for a study of this kind to facilitate appropriate policy intervention. We used pooled regional representative data from the UDHS of 2001 to 2016 to establish demographic and socio-economic factors associated with stunting among under-5 children in Western Uganda.

Figure 1: Trends in Stunting in Western Uganda Compared to National Level (Uganda)



***Source**: UDHS reports 2001 to 2016* (Uganda Bureau of Statistics (UBOS) and ICF International Inc., 2012; Uganda Bureau of Statistics (UBOS) and Macro International Inc., 2007; Uganda Bureau of Statistics (UBOS) and ORC Macro. 2001, 2001; Uganda Bureau of Statistics (UBOS) & ICF, 2018)

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The United Nations and World Health Organization (WHO) set several targets to combat child stunting, including reducing the number of stunted children by 40% (of the 162 million recorded in 2014) by the year 2025 (WHO, 2014). In 2015, the global community also committed to combating stunting through the Sustainable Development Goals by aiming to 'end hunger, achieve food security and improve nutrition and promote sustainable agriculture'. The target is to reduce the number of stunted children to a record low of 83 million by 2030 (Albu, 2021). The global targets continue to be unachievable as the decrease in stunting in Uganda's Western region has only reached 4.5% over the past ten years. Therefore, it is essential to comprehend the underlying causes and offer a feasible solution to tackle stunting.

Several factors that contribute to child stunting have been discussed in the literature. These factors encompass maternal influences, the socio-economic status of mothers, as well as child-related and health or environmental (hygiene) aspects (10,16,17). For example, mothers who were married, with higher education levels, working, and living in rural areas were associated with reduced risks of having stunted children (Laksono et al., 2022; Wulandari et al., 2022). Child-related factors have also been found to be associated with stunting and recommended for control of infection, treatment, and provision of supplements (Oh et al., 2020). Studies also show that nutritional status is a function of food access and security, agricultural practices, climate, and the wealth status of the household, and these play a crucial role in child stunting (Atukunda et al., 2021; Remans et al., 2011; Wheeler & Von Braun, 2013). Using data from the Uganda Demographic and Health Survey of 2001 to 2016, we investigated the interplay between underlying and intermediate factors (Figure 2) and we hypothesized them to include mother and child characteristics, demographic, socio-economic factors, health, immediate breastfeeding after birth, access to health information (including nutrition) and mothers' empowerment.

The Government of Uganda, working with development partners, has been putting in place policies, plans, and interventions to reduce stunting in the country. Uganda's policy on food and nutrition, formulated in 2003, guides related interventions and acknowledges that stunting results in poor health, exacerbates diseases, reduces productivity, and compounds poverty (GoU, 2003). Since 2010, the country has implemented two rounds of 5-year nutrition action plans with the aim of improving the nutritional status of all Ugandans, with emphasis on women of reproductive age, young children, and infants. Additional actions taken by both the Ugandan government and its development partners encompassed, for example, a project known as the Uganda Multisectoral Food Security and Nutrition initiative, which was executed in 15 chosen districts of Western Uganda, targeting an area with the highest prevalence of stunting (25). Other interventions to reduce stunting in Uganda have been through the provision of Vitamin A to under-5 children in government health facilities (MoH, 2021).

CONCEPTUAL FRAMEWORK

We adapted and modified the UNICEF (2020) conceptual framework to come up with independent variables on stunting. The model was based on underlying and immediate factors. These factors were further categorized into demographic, social, economic, environmental, and child-level factors. The characteristics, such as flooring materials, were utilized as one of the proxy variables among the socio-economic factors that indicate a connection between housing characteristics and health outcomes (Dunn, J. R., 2003). We conceptualized these factors and summarized them in Figure 2.

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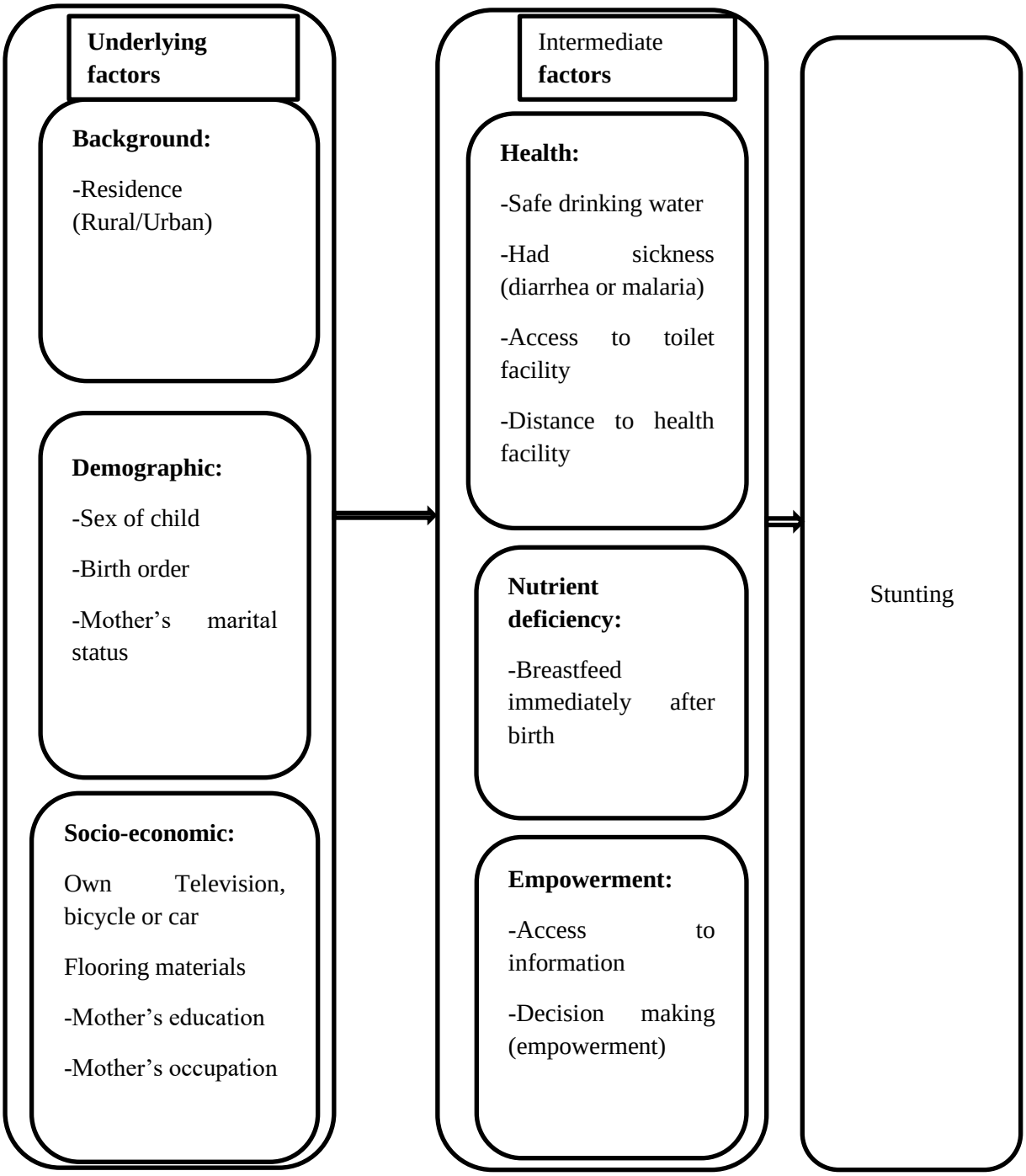
Figure 2: Pathways Through Which Underlying and Intermediate Factors May Affect Stunting



Adapted from UNICEF (2020)

This paper provides the methods and materials used in the study (data sources, sample sizes, and model description), presents the results of the analyses, discusses the findings, and gives conclusions and recommendations.

MATERIALS AND METHODS

Data Management

Pooled data from the UDHS of 2001 to 2016 to obtain enough observations for the Western region were used. We also used data from children aged 24 to 59 months obtained from their mothers.

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The UDHS used a two-stage stratified sampling. In the first stage, Enumeration Areas were selected from the Uganda National Population Housing Census of 2002 and 2014, while the second stage of sampling was at the household level. The total number of 2,110 (weighted sample) children aged 24 to 59 months was used in the analyses.

Measurement of Variables and Statistical Methods

The outcome variable used in the analyses was a -2-standard deviation (sd) score ratio for height and age measures according to the World Health Organization (WHO) standard. Children below the value of 2sd are stunted. We used background, demographic, and socio-economic factors to determine factors associated with stunting. We considered both household, mother and child variables. The variables pertaining to the household and mother included: the child's sex, type of residence (rural or urban), educational attainment, marital status, occupation of the mother, wealth quintile, immediate breastfeeding of the child following birth, instances of child illness (malaria and/or diarrhoea), and the distance to the nearest health facility. In our analyses, we utilized the presence of fever in the child as a proxy indicator for malaria, given that the children were not tested during the survey to verify malaria. The wealth quintile was derived from several consumer goods a household owned, ranging from a television to a bicycle or car, and housing characteristics such as source of drinking water, toilet facilities, and flooring materials.

In the UDHS surveys of 2001 to 2016, data were obtained from mothers on their participation in decision-making using four questions namely: making large household purchases, decisions on what to do with the money the husband earns, visits to family or relatives, and their health care. We used the four questions to derive the mother's empowerment index. The responses from each of the four questions included: 1) respondent (mother) alone, 2) respondent(mother) and husband/partner, 3) husband/partner alone, 4) someone else, 5) husband/partner has no earnings, and 6) others. Mothers who made decisions alone or with their partner were considered empowered and were assigned a code of 1 and 0; otherwise, each obtained a total score ranging from 0 to 4. Mothers who obtained a total score of 3 or 4 were considered empowered. Mothers who scored 0 were categorized as not empowered, while those who scored 1 or 2 were considered less empowered. In the analyses, the empowerment variable was therefore operationalized as a categorized variable to include: 1) not empowered 2) less empowered, and 3) empowered.

Results were presented with their 95% confidence intervals. We tested for multicollinearity among the independent variables and the results depicted weak correlation coefficients ranging from -0.25 to 0.24. A Pearson chi-square test statistic was employed in a bivariate analysis to determine the relationship between stunting and the demographic and socio-economic factors (mother or child). We checked for the suitability of the Pearson chi-square test statistic for expected frequency, and the values obtained were greater than 5. We used a logistic regression model and took into consideration weighted data. We used the Hosmer and Lemeshow goodness of fit test to establish whether the logistic regression model was correctly specified, and the assumptions were not violated. Results show the F-statistic of 1.31 (p = 0.230), indicating no evidence of poor fit. The model is specified as:

$$\text{Log}\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_i X_i$$

Whereby

- X_1 *to* X_i are the covariates
- β_0 to β_i are the regression parameters to be estimated
- P_i is the probability that the ith child aged 24 to 59 months is stunted.

RESULTS

Descriptive Statistics of Respondents

Table 1 provides results showing the association between stunting and selected demographic and

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socio-economic factors. Results show that children who were living in rural areas, male, whose mothers had no education level, were from the poorer and middle wealth quintile, and their mother's main occupation was agriculture, which was associated with high child stunting. In addition, children who were not put on breast milk immediately after birth had had diarrhoea two weeks before the survey, whose mothers were not empowered and did not have access to health information, were significantly associated with child stunting. The marital status of mothers, the distance to health facilities, the order of the child's birth, and the occurrence of fever were not significantly associated with stunting.

More of the children living in rural areas (49%) were stunted compared to those in urban areas (32%). More of the male children (55%) were significantly associated with stunting compared to females (45%). Children whose mothers lacked any formal education were significantly associated with stunting compared to those who had attained at least primary education. Those from the poorer and middle wealth quintiles were significantly associated with higher proportions of stunted children compared to those from the richest households. Results also show that children whose mothers were involved in agriculture were significantly associated with stunting (51%) compared to those involved in other forms (36%) of occupation. Newborns when put on breast milk immediately after birth were associated with a lower proportion of stunted children (50%) compared to those who were not (44%). Children who had had diarrhoea two weeks prior to the survey were significantly associated with stunting. Children whose mothers received health information either through radio, television, or any other media, were less associated with stunting (44%) compared to those who did not (55%).

Table 1: Socio-economic Factors Associated with Children Aged 24-59 Months Stunting

Characteristics	Not stunted	Stunted	n(weighted)	p-value
Type of place of residence				
Urban	68.1	31.9	189	0.001
Rural	51.1	48.9	1,921	
Sex of the child				
Male	50.0	50.0	1042	0.036
Female	55.1	44.9	1068	
Mother's Highest educational level				0.000
None	45.0	55.0	496	
Primary	52.2	47.8	1,358	
Secondary	64.1	35.9	195	
Higher	85.7	14.3	60	
Marital status of the mother				
Never married	54.5	45.5	47	0.946
Married	52.6	47.4	1,869	
Ever married	51.7	48.3	194	
Wealth Quintile				
Poorest	52.3	47.2	332	0.012
Poorer	49.5	50.6	471	
Middle	46.5	53.5	528	
Rich	56.4	43.6	516	
Richest	62.7	37.3	263	
Occupation				
Not working	54.1	45.9	230	0.000
Agriculture	49.2	50.8	1,474	
Others	64.1	36.0	406	

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Characteristics	Not stunted	Stunted	n(weighted)	p-value
When the child was put to the breast	50.0	50.0	1,258	0.012
Not immediately	56.4	43.6	851	
Immediately				
Had diarrhoea				
No	53.8	46.2	1,873	0.012
Yes	43.2	56.8	237	
Had fever				
No	53.1	46.9	1,559	0.541
Yes	51.3	48.8	551	
Distance to health facility				
A big problem	51.4	48.6	1,126	0.337
Not a big problem	53.9	46.1	983	
Birth order				
1-3	51.2	48.9	1,005	0.364
4-6	54.8	45.2	725	
7+	52.1	47.9	380	
Women Empowerment				
Not empowered	47.2	52.8	499	0.021
Somehow	51.3	48.7	580	
Empowered	55.9	44.9	1,030	
Receive health information				
No	45.9	54.1	616	0.000
Yes	55.3	44.7	1,493	
Total	52.5	47.4	2,110	-

Source: Uganda Demographic and Health Survey (UDHS) 2016 dataset, Uganda Bureau of Statistics (UBOS), and ICF

Table 2 presents results from a logistic regression model to establish factors associated with stunting. The main factors significantly associated with increased odds of stunting included: being a male child, a mother with no education level, a mother not empowered, having diarrhoea, and a lack of health information. The factors of location (rural or urban), wealth quintile, marital status, mother's occupation, distance to the health facility, the child's birth order, and whether the child experienced fever or was promptly breastfed after birth did not show a significant association with stunting.

Stunting was significantly higher among male children (odds=1.2) compared to females. Results also show that children whose mothers had attained higher levels of education were significantly associated with reduced odds (0.2) of stunting compared to those with no education. Children from mothers who were empowered were associated with reduced odds (0.7) of stunting compared to those who were not empowered. Children who had had diarrhoea two weeks prior to the survey were associated with higher odds (1.5) of stunting compared to those who did not have the disease. Children whose mothers had not received health information were associated with increased odds (1.3) of stunted growth.

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Table 2: Logistic Model Results on Demographic and Socio Factors Associated with Under-5 (24-59 months) Stunting

Variable	Odds	95% CI
Sex of child (ref: female) male	1.24*	1.03 - 1.51
Location (Ref: Urban) Rural	1.27	0.83-1.94
Wealth Quantile (Ref: Poorest)		
Poor	1.15	0.79 - 1.68
Middle	1.47	0.99 - 2.18
Rich	0.99	0.66 - 1.48
Richer	1.01	0.64 - 1.59
Mother's education level (Ref: None)		
Primary	0.77*	0.61 - 0.97
Secondary	0.59*	0.39 - 0.92
Higher	0.23**	0.10 - 0.53
Marital status of mother (Reference=single)		
Married	1.43	0.68 – 2.98
Ever married	1.23	0.56 - 2.68
Respondent's occupation (Ref: Not employed)		
Agriculture self-employed	1.22	0.90 - 1.65
Other occupation	0.88	0.62 - 1.26
Distance to health facility (Ref: a problem) Small or no problem	1.02	0.82 - 1.27
Empowerment Index (Not empowered)		
Somehow	0.82	0.60 - 1.11
Empowered	0.73*	0.56 – 0.96
Child was put to the breast (Ref: immediately) Not Immediate	1.13	0.92 - 1.39
Had diarrhoea recently (Ref: No) Had diarrhoea	1.48*	1.04 – 2.10
Had fever in last two weeks (Ref: No) Yes	0.97	0.76 - 1.24
Type of place of residence (Ref: Urban) Rural	1.27	0.83 - 1.94
Received health information (Ref: Yes) No information	1.31*	1.05 - 1.63
Birth order number (Ref:7+)		
<=3	1.22	0.93-1.61
4-6	0.97	0.73– 1.28

*** p<0.01, * p<0.05*

Source: Uganda Demographic and Health Survey (UDHS) 2016 dataset, Uganda Bureau of Statistics (UBOS), and ICF

DISCUSSION

We conducted an analysis of the underlying (background, demographic, and socio-economic) and immediate (environmental, nutritional, and empowerment) factors likely to be associated with stunting in Western Uganda. We used UDHS pooled data for the period 2001 to 2016 for children aged 24 to 59 months. Our analyses identified socio-economic, environmental, and access to information as being associated with stunting of children aged 24 to 59 months. The findings indicate that stunting was notably associated with a higher likelihood of being a male child, having mothers with no educational background, experiencing diarrhoea, having mothers who did not receive health information, and being from less empowered maternal backgrounds.

Results show that male children have higher odds of stunting compared to females. Available literature shows that male infants are at greater risk of stunting compared to females, and plausible factors include their weaker genetic and biological makeup (Boco, 2014; Pongou, 2013; Thompson A. L., 2021; Wamani H, Åstrøm AN, Peterson S, Tumwine JK, Tylleskär T., 2007). In

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Uganda, stunting has also been higher among males compared to females. For instance, statistics show that 31 percent of under-5 males were stunted compared to 27 percent of females (Uganda Bureau of Statistics (UBOS) & ICF, 2018). It could also be possible that under-5 girl child is given nutritional care in some cultural settings in Uganda compared to males, as supported by some literature [(Svedberg, 1990)]. This could be attributed to the cultural norm of viewing the girl-child as a future source of wealth through bride price, such as cows, a practice that is predominant in Western Uganda.

Our findings show that children whose mothers had no education level were associated with high levels of stunting compared to those who had at least a primary level of education. Studies [(Abuya et al., 2012; Handayani et al., 2017; Monteiro et al., 2010; Musbah & Worku, 2016)] have shown a strong association between a mother's education level and child stunting. The association between low education and stunting could be because such mothers are more likely to have low levels of income and hence face a challenge in providing food with adequate nutrition for their children compared to educated mothers. It is also probable that mothers with low levels of education may not easily understand health-related messages on nutrition and proper feeding for their under-5 children compared to educated mothers.

Children who had suffered from diarrhoea two weeks prior to the survey were associated with stunting. Our findings are consistent with other studies on how diarrhoea is associated with stunting (Berkman et al., 2002]; [Danaei et al., 2016). Episodes of diarrhoea in children under the age of five are more likely to result in a loss of appetite, which subsequently limits their intake of essential nutrients, ultimately leading to stunting. It is also possible that the bodies of children with diarrhoea cannot easily absorb nutrients due to intestinal infections (Vecchio et al., 2021) leading to stunting. Diarrhoea also depletes vitamin A (WHO, 2011) from the body which is critical for a child's immunity, further exacerbating stunting.

Results show that children whose mothers had not received health information were associated with high odds of stunting, and this finding is consistent with similar studies ([Puett & Guerrero, 2014]). Mothers are usually the primary caregivers of their children and when they are empowered with information, they are likely to make better decisions on the health and feeding of their children to improve their nutrition and hence reduce stunting. Mothers who had received health information could have had a message on how to reduce stunting for their children, for example, on the use of Vitamin A. In Uganda, government health facilities have been giving vitamin A to combat stunting among children under 5 (26). Vitamin A is critical for reducing morbidity and mortality among children aged 24-59 months, thereby reducing stunting. In addition, the Western region is described as a "food basket." (Kikafunda et al., 2014) for the country characterized by fertile soils and two well-spaced rainy seasons in a year. The western region has great potential to have foods at household levels that are rich in vitamin A, such as green leafy vegetables, eggs, ripe mangoes or papayas, but the challenge is likely to be a lack of information about their importance in reducing stunting.

Children whose mothers were empowered were significantly associated with reduced odds of stunting, and this is supported by a number of other related studies (Kumar R, Lakhtakia S., 2021; Margatot & Huriah, 2021; Wassie EG, Tenagashaw MW, Tiruye TY., 2024). This study was done in a predominantly patriarchal society of the Western region of the country, where men make decisions at the household level. In situations where women are empowered, there is a high likelihood that they possess knowledge about delivering proper nutrition for their children. It is also plausible that empowered women are more likely to make prompt decisions concerning their children's care and medical needs.

CONCLUSIONS

Findings show that stunting among children aged 24 to 59 months was associated with being male,

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children whose mothers had no education level, mothers who had not received health information, children who had had diarrhoea, and children whose mothers were not empowered. The findings call for increased care of the male children, education of the girl child, increased access to health information for mothers, prevention and prompt treatment of diarrhoea, and sensitization aimed at empowering women.

Author Contributions: The study was conceived and designed by A.J.B., T.R., K.C., S.S.H., and R.W. The data were analyzed by A.J.B. and T.R. Consequently, A.J.B. wrote the first draft of the manuscript and is responsible for the final content. All authors read and approved the final manuscript.

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Institutional Review Board Statement: This study utilized secondary data that was obtained with permission after registration with the website https://dhsprogram.com.

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Conflicts of Interest: There are no competing interests.

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