Journal of Applied Sciences, Information and Computing
Volume 6, Issue 2, Nov - Dec 2025
School of Mathematics and Computing, Kampala International University

ISSN: 3007-8903 https://doi.org/10.59568/JASIC-2025-6-2-07

Risk Factors Associated with Malnutrition among children under 5 years in Uganda

[1]Babalola Bayowa Teniola, [2]Iradukunda Orly Davis, [3]Abdullahi Baba Muhammed, [4]Ibrahim Abdullahi

[1,3]Department of Mathematics and Statistics, School of Mathematics and Computing, Kampala International University, Uganda., abdullahi.baba@kiu.ac.ug
[2]Department of Statistics, Faculty of Science, Ekiti State University, Ado-Ekiti, Nigeria
[4]Department of Mathematics, Faculty of Science, Northwest University, Kano State, Nigeria

Abstract

This study investigates the demographic, socioeconomic, and feeding practice risk factors linked to malnutrition among children under five years in Uganda, using data from the Uganda Demographic and Health Surveys (UDHS) of 2006, 2011, and 2016. A pooled cross-sectional analysis of 10,152 children under five years was conducted using nationally representative UDHS datasets. Logistic regression was used to assess associations between malnutrition indicators (stunting, wasting, and underweight) and independent variables.Malnutrition showed significant associations with child age, sex, birth interval, perceived size at birth, maternal education and BMI, household wealth index, and breastfeeding practices. Stunting emerged as the most prevalent form of malnutrition, with rural residence, low maternal education, and non-exclusive breastfeeding as key predictors.Malnutrition among under-five children in Uganda is driven by multifactorial influences. Targeted policy interventions should emphasize maternal health education, socioeconomic empowerment, and breastfeeding support.

Keywords: Malnutrition, Under-five children, Logistic regression, Uganda, Stunting.

1. Introduction

Malnutrition remains a critical public health challenge globally, particularly for children in low- and middle-income countries (LMICs). It includes both under nutrition and over nutrition, though under nutrition is far more prevalent and dangerous in these settings. According to global estimates, nearly half of all deaths among children under the age of five are linked to under nutrition. In 2019 alone, 144 million children were stunted, 47 million were wasted, and almost 39 million were overweight figures that highlight the widespread and complex nature of this crisis.

Children suffering from malnutrition are more vulnerable to infections and are likely to experience those infections more severely and more frequently. Among the most common indicators of malnutrition are stunting (low height for age), wasting (low weight for height), and underweight (low weight for age). These conditions are particularly pronounced in regions such as South Asia and sub-Saharan Africa, which together account for the highest global burden of child under nutrition.

Malnutrition not only undermines individual health but also hampers national productivity. Children affected by it often face lifelong disadvantages reduced school achievement, lower income potential, and greater risk of chronic diseases. In response, the World Health Organization has set global targets to reduce stunting by 40% and keep wasting below 5% by 2025. However, progress in sub-Saharan Africa has been slow. While some countries are on track to meet specific nutrition goals, stunting and wasting rates remain high, exacerbated by population growth and persistent poverty.

In Uganda, malnutrition is a pressing issue. Nearly one in three children under five is stunted, with prevalence increasing sharply between 18 and 35 months of age. Stunting is more common in rural areas and among children whose mothers have little or no formal education. Similarly, children from poorer households are more likely to be stunted or underweight. Regional disparities are also evident, with the West Nile and Karamoja regions reporting wasting rates as high as 10%.

Although several government programs and policies such as the Uganda Nutrition Action Plan and Infant and Young Child Feeding Guidelines have been implemented to address child malnutrition, challenges persist. In 2016, for example, 29% of Ugandan children under five were stunted, and 11% were underweight—both figures above the global average.

Numerous studies have explored the determinants of child malnutrition in Uganda, often pointing to factors such as household poverty, maternal education, birth intervals, child sex, immunization status, and access to healthcare. However, most of these studies have been district-specific and lack a national scope. This study, therefore, seeks to fill that gap by conducting a comprehensive logistic regression analysis of nationally representative data from the Uganda Demographic and Health Surveys (UDHS) conducted in 2006, 2011, and 2016. It aims to identify consistent risk factors for malnutrition among children under five across Uganda and inform more targeted interventions

2. Methodology

This study employed a quantitative cross-sectional research design using data from the Uganda Demographic and Health Surveys (UDHS) conducted in 2006, 2011, and 2016. These nationally representative surveys provided comprehensive information necessary to explore the risk factors associated with malnutrition among children under five in Uganda.

The cross-sectional approach allowed the researchers to analyse the relationship between child malnutrition—measured through stunting, wasting, and underweight and a wide range of demographic, socio-economic, and feeding-related variables at a single point in time. Although this design does not establish causality, its repeated application across three survey periods enabled the identification of consistent patterns and evolving trends over a decade. To further account for temporal changes, pooled cross-sectional analysis was conducted to observe shifts in risk factors over time. The study population comprised children aged 6 to 59 months whose anthropometric measurements were recorded during the respective survey years. This age range was selected based on existing evidence identifying it as a high-risk group for malnutrition and the primary target for most nutrition interventions (Bhutta et al., 2013). Sampling for each UDHS followed a two-stage stratified cluster design. In 2016, the sampling frame was drawn from the 2014 Uganda National Population and Housing Census. A total of 697 enumeration areas (EAs) 162 urban and 535 rural were selected in the first stage. From these, 20,880 households were systematically selected in the second stage, with data collection occurring between April and October 2016.

For the 2011 survey, the sampling frame was based on the 2009/10 Uganda National Household Survey, involving 404 EAs and 10,086 households. Similarly, the 2006 survey drew its frame from the 2005/06 National Household Survey, selecting 321 clusters and 9,864 households for participation. Each round ensured a balance between urban and rural representation to support generalizability of the findings.

The primary tool used for data collection was the Woman's Questionnaire, which was part of the standard UDHS instruments. This questionnaire captured relevant information on maternal characteristics such as age, education level, employment, breastfeeding practices, and child feeding habits. These variables were key to understanding the contextual factors influencing child nutritional outcomes. Data analysis was conducted using SPSS version 23.0. Descriptive

statistics (frequencies and percentages) were generated to summarize demographic and socio-economic characteristics of the participants. Chi-square tests were employed to assess associations between independent variables and malnutrition indicators, providing a foundation for deeper regression analysis.

3. Results

The study examined a range of demographic characteristics that are potentially linked to malnutrition outcomes in children under five. These included the child's age, sex, birth interval, and size at birth, as well as maternal factors such as nutritional status, education level, and place of residence. Household economic status, represented by wealth quintiles, was also considered. A summary of these variables across the three survey years is presented in Table 1

Table 1: Socio-Demographic Characteristics of the Study Participants

Socio-demographic	2016	2011	2006
Age in months	N=5,117	N=2,350	N=2,685
< 6	468 (9%)	228 (10%)	242 (9%)
6-8	265 (5%)	131 (6%)	144 (5%)
9-11	254 (5%)	120 (5%)	144 (5%)
12-17	500 (10%)	245 (10%)	298 (11%)
18-23	507 (10%)	269 (11%)	280 (10%)
24-35	1,063 (21%)	444 (19%)	535 (20%)
36-47	1,043 (20%)	477 (20%)	521 (19%)
48-59	1,017 (20%)	436 (19%)	521 (19%)
Sex	N=5,117	N= 2,351	N= 2,687
Male	2,569 (50%)	1,163 (49%)	1,357 (51%)
Female	2,548 (50%)	1,188 (51%)	1,330 (49%)
Birth interval in month	N=4,357	N=2,053	N=2,408
First birth	845 (19%)	331 (16%)	363 (15%)
< 24	824 (19%)	419 (20%)	473 (20%)
24-47	1,986 (46%)	1,025 (50%)	1,285 (53%)
48+	702 (16%)	278 (14%)	287 (12%)
Size at birth	N=4,281	N= 1,998	N=2,394
Very small	235 (5%)	100 (5%)	126 (5%)
Small	635 (15%)	338 (17%)	349 (15%)
Average or larger	3,411 (80%)	1,560 (78%)	1,919 (80%)
Mother's nutritional status	N=3,554	N= 2,090	N=2,429
Thin (BMI <18.5)	314 (9%)	202 (10%)	257 (11%)
Normal (BMI 18.5-24.9)	2,454 (69%)	1,541 (74%)	1,832 (75%)
Overweight/Obese (BMI ≥ 25)	786 (22%)	347 (16%)	340 (14%)
Residence	N=5,118	N=2,350	N=2,687
Urban	977 (19%)	307 (13%)	273 (10%)
Rural	4,141 (81%)	2,043 (87%)	2,414 (90%)
Mother's education	N=4,186	N=2,138	N=2,470
No education	590 (14%)	275 (13%)	551 (22%)
Primary	2,703 (65%)	1,406 (66%)	1,580 (64%)
Secondary+	893 (21%)	457 (21%)	339 (14%)
Wealth quintile	N=5,117	N=2,351	N=2,687
Lowest	1,134 (22%)	505 (21%)	554 (21%)
Second	1,050 (21%)	509 (22%)	591 (22%)
Middle	1,058 (21%)	487 (21%)	578 (22%)
Fourth	971 (19%)	445 (19%)	501 (19%)
Highest	904 (17%)	405 (17%)	463 (16%)

Source: UDHS (2006, 2011, 2016)

The study explored several background characteristics that may affect child nutrition. These included the child's

The study explored several background characteristics that may affect child nutrition. These included the child's age, gender, birth spacing, and size at birth, along with the mother's health, education level, and place of residence. Household wealth was also taken into account. Table 1 presents a summary of these key variables across the survey years

Table 2: Univariate Analysis of Demographic Factors, Socio Economic Factors, and Feeding Practice with Malnutrition among Under-Five Children

	2016				2011				2006			
Age in months	No. of children	Stunted (%)	Wasting (%)	Under-weight (%)	No. of children	Stunted (%)	Wasting (%)	Under-weight (%)	No. of children	Stunted (%)	Wasting (%)	Under-weight (%)
< 6	468	24 (5.2%)	22(4.6%)	20(4.2%)	228	10(4.6%)	10(4.4%)	7(3.2%)	242	13(5.4%)	6(2.3%)	6(2.4%)
6-8	265	13 (4.8%)	9(3.4%)	10(3.6%)	131	3(2.3%)	8(6.0%)	9(7.0%)	144	8(5.9%)	4(2.6%)	4(2.6%)
9-11	254	15 (5.9%)	8(3.0%)	9(3.6%)	120	7(5.8%)	0(0.0%)	0(0.0%)	144	19(12.9%)	15(10.1%)	19(13.1%)
12-17	500	45 (9.0%)	6(1.2%)	17(3.4%)	245	33(13.5%)	3(1.4%)	8(3.4%)	298	35(11.7%)	15(5.0%)	19(6.3%)
18-23	507	56 (11.1%)	7(1.4%)	12(2.4%)	269	51(19.1%)	3(1.2%)	16(5.9%)	280	47(16.8%)	8(3.0%)	17(5.9%)
24-35	1,063	146 (13.7%)	5(0.5%)	26(2.4%)	444	83(18.7%)	2(0.4%)	13(2.9%)	535	116(21.7%)	4(0.8%)	19(3.6%)
36-47	1,043	99(9.5%)	7(0.7%)	14(1.3%)	477	80(16.7%)	2(0.5%)	19(3.9%)	521	80(15.3%)	2(0.3%)	14(2.7%)
48-59	1,017	75(7.4%)	5(0.5%)	13(1.3%)	436	55(12.7%)	6(1.4%)	9(2.0%)	521	84(16.1%)	5(0.3%)	14(2.7%)
Sex												
Male	2,569	288(11.2%)	44(1.7%)	69(2.7%)	1,163	12(15.6%)	12(1.0%)	35(3.0%)	1,357	228(16.8%)	30(2.2%)	57(4.2%)
Female	2,548	186(7.3%)	25(1.0%)	51(2.0%)	1,188	141(12%)	23(1.9%)	45(3.8%)	1,330	174(13.1%)	24(1.8%)	55(4.1%)
Birth interval in month												
First birth	845	69(8.2%)	8(1.0%)	20(2.4%)	331	39(11.9%)	4(1.2%)	9(2.6%)	363	57(15.6%)	9(2.6%)	16(4.3%)
< 24	824	101(12.3%)	12(1.4%)	21(2.5%)	419	76(18.1%)	5(1.1%)	37(3.6%)	473	88(18.5%)	9(2.0%)	26(5.5%)
24-47	1,986	179(9.0%)	28(1.4%)	50(2.5%)	1,025	141(14%)	19(1.9%)	35(3.4%)	1,285	171(13.3%)	26(2.0%)	45(3.5%)
48+	702	36(5.1%)	12(1.7%)	12(1.7%)	278	24(8.6%)	5(1.8%)	11(4.1%)	287	26(9.1%)	9(3.2%)	12(4.3%)
Size at birth												
Very small	235	39(16.6%)	8(3.6%)	24(10.2%)	100	24(23.7%)	5(5.1%)	6(11.0%)	126	25(19.5%)	8(6.0%)	12(9.9%)
Small	635	77(12.1%)	13(2.1%)	23(3.6%)	338	50(14.9%)	1.7%	15(4.5%)	349	70(20.0%)	13(3.8%)	23(6.5%)
Average or larger	3,411	259(7.6%)	34(1.0%)	51(1.5%)	1,560	198(13%)	1.4%	41(2.6%)	1,919	244(12.7%)	33(1.7%)	63(3.3%)
Mother's nutritional status												
Thin (BMI <18.5)	314	27(8.6%)	10(3.2%)	15(4.9%)	202	27(13.2%)	3(1.7%)	12(6.0%)	257	31(11.9%)	10(3.8%)	17(6.5%)
Normal (BMI 18.5-24.9)	2,454	240(9.8%)	32(1.3%)	71(2.9%)	1,541	227(15%)	25(1.6%)	51(3.3%)	1,832	282(15.4%)	40(2.2%)	77(4.2%)
Overweight/Obese (BMI ≥ 25)	786	49(6.2%)	2(0.3%)	7(0.9%)	347	36(10.3%)	5(1.3%)	8(2.2%)	340	34(10.0%)	4(1.2%)	6(1.9%)
Residence												

Urban	977	69(7.1%)	9(0.9%)	13(1.3%)	307	17(5.6%)	7(2.3%)	3(1.1%)	273	23(8.3%)	8(3.0%)	7(2.5%)
Rural	4,141	406(9.8%	58(1.4%)	108(2.6%)	2,043	306(15%)	29(1.4%)	78(3.8%)	2,414	379(15.7%)	46(1.9%)	104(4.3%)
Mother's education												
No education	590	72(12.2%)	9(1.6%)	24(4.1%)	275	53(19.1%)	7(2.7%)	17(6.1%)	551	87(15.8%)	13(2.4%)	33(5.9%)
Primary	2,703	265(9.8%)	38(1.4%)	68(2.5%)	1,406	204(15%)	21(1.5%)	45(3.2%)	1,580	245(15.5%)	35(2.2%)	62(3.9%)
Secondary+	893	48(5.4%)	12(1.3%)	13(1.4%)	457	71(8.0%)	5(1.2%)	11(2.3%)	339	24(7.1%)	6(1.7%)	9(2.6%)
Wealth quintile												
Lowest	1,134	115(10.1%)	24(2.1%)	43(3.8%)	505	95(18.9%)	7(1.3%)	29(5.8%)	554	102(18.5%)	9(1.6%)	30(5.5%)
Second	1,050	128(12.2%)	18(1.7%)	25(2.4%)	509	64(12.5%)	10(2.0%)	16(3.2%)	591	95(16.0%)	12(2.0%)	20(3.3%)
Middle	1,058	113(10.7%)	12(1.1%)	26(2.5%)	487	90(18.4%)	5(1.0%)	21(4.4%)	578	100(17.3%)	15(2.6%)	24(4.2%)
Fourth	971	82(8.4%)	8(0.8%)	17(1.8%)	445	52(11.7%)	9(2.0%)	9(2.0%)	501	69(13.7%)	12(2.4%)	31(6.1%)
Highest	904	37(4.1%)	6(0.7%)	8(0.9%)	405	22(5.5%)	4(1.0%)	5(1.3%)	463	40(7.9%)	6(1.4%)	7(1.5%)
Breastfeeding practices												
NBF	1,061	80(7.3%)	12(3.3%)	100(9.4%)	536	18(3.4%)	40(7.5%)	45(8.4%)	424	146(4.4%)	19(3.2%)	10(2.4%)
EBF	1,076	57(5.3%)	4 (1.2%)	16(1.5%)	753	10(1.3%)	18(2.4%)	32(4.3%)	530	191(3.0%)	6(1.1%)	5(0.9%)
BFCCF	3,318	96(2.9%)	7(0.2%)	27(0.8%)	1,671	8(0.5%)	3(0.2%)	38(2.3%)	1,947	610(1.3%)	8(0.4%)	6(0.3%)

Source: UDHS (2006, 2011, 2016)

important patterns in malnutrition among children under five. The study assessed stunting, wasting, and underweight in relation to demographic, health, and socioeconomic factors.

Across all years, stunting was most common among children aged 24 to 47 months, while wasting and underweight were more prevalent in infants under one year. Boys consistently had higher rates of malnutrition than girls.

Key risk factors included short birth intervals (less than 24 months), very small size at birth, and maternal under nutrition. Children in rural settings were more affected than those in urban areas, pointing to inequality in access to healthcare, nutrition, and sanitation. Children of mothers with no education and from poorer households were also significantly more vulnerable.

Exclusive breastfeeding emerged as a strong protective factor. Children who were not breastfed had a much higher likelihood of being malnourished. Statistical analysis confirmed significant links between malnutrition and variables such as age, sex, birth spacing, birth size, maternal body mass index, residence, and education, wealth, and breastfeeding practices. Logistic regression further highlighted that boys, rural children, and those with undernourished or uneducated mothers, as well as those not breastfed, were at particularly high risk.

Overall, malnutrition in Uganda is driven by a mix of biological, social, and economic factors. Addressing it requires targeted actions—improving maternal health and education, encouraging longer birth intervals, and promoting exclusive breastfeeding.

4. Discussion

The Uganda Demographic and Health Survey (UDHS) data from 2006, 2011, and 2016 identified several key demographic and socio-economic factors linked to malnutrition among children under five. Among the demographic indicators, child's age, sex, birth interval, size at birth, and rural or urban residence were significant. Children living in rural areas were more vulnerable due to limited access to healthcare, poor dietary variety, and low household income. Mothers without formal education also contributed to higher malnutrition risks, as they may lack awareness of recommended child spacing and proper feeding practices, increasing the likelihood of frequent childbirth and low birth weight.

Gender disparities were evident, with boys more likely to be malnourished than girls. This could stem from cultural preferences favoring girls in rural communities, where daughters are seen as future sources of dowry. Additionally, children born within less than 24 months of their siblings faced higher risks due to reduced maternal care and breastfeeding overlap.These findings align with prior studies—Maniragaba et al. (2022), Nahalomo et al. (2022), Modjadji and Mashishi (2020), Tekile et al. (2019), Mawa and Lawoko (2018), and Poda et al. (2017)—which consistently identified child's sex, age, size at birth, maternal education, and BMI as crucial risk factors.

Socio-economic influences such as maternal education level, maternal nutritional status, and household wealth were also key contributors. Mothers without education are less likely to secure formal employment or understand essential maternal and child health practices, including antenatal care and balanced feeding (Li et al., 2020; Liu et al., 2021; Mahmood et al., 2016). Poor households in the lowest wealth quintiles often lack access to nutritious food, clean water, and healthcare, increasing malnutrition risks (Quatela et al., 2020; Adedokun & Yaya, 2021; Binagwaho et al., 2020; Habimana & Biracyaza, 2019; Nshimwe, 2019). Breastfeeding practices also played a critical role. Children who were not breastfed, especially during the first six months, were more likely to suffer from malnutrition and related illnesses, such as diarrhea and respiratory infections, which hinder healthy development (Toma et al., 2023).

5. Conclusion

The study found that the demographic factors associated with malnutrition in children under five in UDHS 2016, 2011, and 2006, included, age, sex, birth interval, size at birth, and residence. Similarly, the study revealed that the socio-economic factors associated with malnutrition in children under five in UDHS 2016, 2011, and 2006 included, mother's nutritional status, mother's education, and wealth quintile. In addition, the study revealed that breastfeeding practices associated with malnutrition in children under five in UDHS 2016, 2011, and 2006 is 'not breastfeeding'. Malnutrition in children is one of the health challenges in Uganda. Malnutrition-related mortality and morbidity is a burden on national budget at one end and on health care institutions on the other. This important issue can be

handled with multipronged policies and multidimensional and multisector cooperation and integration. The focus of all these programs should be the mother in terms of, employment, literacy, healthcare, food, shelter, and social equality.

6. References

[1] World Health Organization (2021). Levels and trends in child malnutrition: UNICEF.

[2] Global Nutrition Report (2021). *The state of global nutrition*. Bristol, UK: Development Initiatives.

[3] UNICEF. (2020). Malnutrition. https://data.unicef.org/topic/nutrition/ malnutrition/. Accessed 27 January 2023

[4] [3] Fanzo, J, Hawkes C, Udomkesmalee E, et al. (2018). *Global nutrition report: shining a light to Spur action on nutrition*. U.S. Agency for International Development (USAID). (2020). *Country Profile: Uganda.* Washington, DC: USAID.

[5] Ruia, A., Gupta, R. K., & Bandyopadhyay, G. (2018). Implication of Malnutrition on Human Capital: Bridging the Inequality through Robust Economic Policies. *Indian Journal of Public Health Research & Development*, *9*(1).

[6] Hall, J., Walton, M., Van Ogtrop, F., Guest, D., Black, K., & Beardsley, J. (2020). Factors influencing undernutrition among children under 5 years from cocoa-growing communities in Bougainville. *BMJ global health*, *5*(8), e002478.

[7] Wu, G., Imhoff-Kunsch, B., & Girard, A.W. (2012). Biological mechanisms for nutritional regulation of maternal health and fetal development. *Paediatr Perinat Epidemiol*; 26 Suppl 1:4–26.United Nations (DESA) (2016). *Transforming our world: the 2030 agenda for sustainable development*, 2016.

[8] FAO, UNICEF, & WFP (2019). *Placing nutrition at the centre of social protection. Asia and the Pacific regional overview of food security and nutrition 2019*. Bangkok: FAO, 2019.

[9] Uganda Bureau of Statistics (UBOS) and ICF International Inc. (2018). *Uganda Demographic and Health Survey 2016*. Kampala, Uganda: UBOS, and Rockville, Maryland, USA: UBOS and ICF International Inc.

[10] Amare, D., Negesse, A., Tsegaye, B., Assefa, B., & Ayenie, B. (2016). Prevalence of undernutrition and its associated factors among children below five years of age in Bure Town, West Gojjam Zone, Amhara National Regional State, Northwest Ethiopia. *Advances in Public Health*, *2016*.

[11] Gebre, A., Reddy, P. S., Mulugeta, A., Sedik, Y., & Kahssay, M. (2019). Prevalence of malnutrition and associated factors among under-five children in pastoral communities of Afar Regional State, Northeast Ethiopia: a community-based cross-sectional study. *Journal of nutrition and metabolism*, *2019*.

[12] Kang, Y., & Kim, J. (2019). Risk factors for undernutrition among children 0–59 months of age in Myanmar. *Maternal & child nutrition*, *15*(4), e12821.

[13] Nzefa, L., Monebenimp, F., & Äng, C. (2019). Undernutrition among children under five in the Bandja village of Cameroon, Africa. *South African Journal of Clinical Nutrition*, *32*(2), 46-50.

[14] Kabugho, M. C. (2021). *Factors Leading to Malnutrition in Children Under Five Years in Nyamwamba Division, Kasese Municipality, Kasese District* (Doctoral dissertation, Kabale University).

[15] Nahalomo, A., Iversen, P. O., Andreassen, B. A., Kaaya, A. N., Rukooko, A. B., Tushabe, G., ... & Rukundo, P. M. (2022). Malnutrition and associated risk factors among children 6–59 months old in the landslide-prone Bududa District, Eastern Uganda: A cohort study. *Current Developments in Nutrition*, *6*(2), nzac005.

[16] Modjadji, P., & Mashishi, J. (2020). Persistent malnutrition and associated factors among children under five years attending primary health care facilities in Limpopo Province, South Africa. *International Journal of Environmental Research and Public Health*, *17*(20), 7580.

[17] Tekile, A. K., Woya, A. A., & Basha, G. W. (2019). Prevalence of malnutrition and associated factors among under-five children in Ethiopia: evidence from the 2016 Ethiopia Demographic and Health Survey. *BMC research notes*, *12*(1), 1-6.

[18] Mawa, R., & Lawoko, S. (2018). Malnutrition among Children Under Five Years in Uganda. American Journal of Health Research. Vol. 6, No. 2, 2018, pp. 56-66. doi: 10.11648/j.ajhr.20180602.14.

[19] Maniragaba, V. N., Leonard, A., & Rutayisire, P. C. (2022). Modelling the risk

factors of malnutrition amongst children below five years of age in Uganda. A GSEM based analysis. *medRxiv*.

[20] Li, Z., Kim, R., Vollmer, S., & Subramanian, S. V. (2020). Factors associated with child stunting, wasting, and underweight in 35 low-and middle-income countries. *JAMA network open*, *3*(4), e203386-e203386.

[21] [20] Liu, J., Sun, J., Huang, J., & Huo, J. (2021). Prevalence of malnutrition and associated factors of stunting among 6–23-month-old infants in Central Rural China in 2019. *International journal of environmental research and public health*, *18*(15), 8165.

[22] Mahmood, S., Nadeem, S., Saif, T., Mannan, M., & Arshad, U. (2016). Nutritional status and associated factors in under-five children of Rawalpindi. *Journal of Ayub Medical College Abbottabad*, *28*(1), 67-71.

[23] Quatela, A., Patterson, A., Callister, R., & MacDonald-Wicks, L. (2020). Breakfast consumption habits of Australian men participating in the "Typical Aussie Bloke" study. *BMC nutrition*, *6*(1), 1-9.

[24] Adedokun, S. T., & Yaya, S. (2021). Factors associated with adverse nutritional status of children in sub-Saharan Africa: Evidence from the Demographic and Health Surveys from 31 countries. *Maternal & Child Nutrition*, *17*(3), e13198.

[25] Binagwaho, A., Rukundo, A., Powers, S., Donahoe, K. B., Agbonyitor, M., Ngabo, F., ... & Smith Fawzi, M. C. (2020). Trends in burden and risk factors associated with childhood stunting in Rwanda from 2000 to 2015: policy and program implications. *BMC Public Health*, *20*(1), 1-9.

[26] Habimana, S., & Biracyaza, E. (2019). Risk factors of stunting among children under 5 years of age in the eastern and western provinces of Rwanda: analysis of Rwanda demographic and health survey 2014/2015. *Pediatric health, medicine and therapeutics*, 115-130.

[27] Nshimwe, L. (2019). *Factors associated with severe acute malnutrition among under five years childrens at a selected district hospital, Rwanda* (Doctoral dissertation, University of Rwanda).

[28] Toma, T. M., Andargie, K. T., Alula, R. A., Kebede, B. M., & Gujo, M. M. (2023). Factors associated with wasting and stunting among children aged 06–59 months in South Ari District, Southern Ethiopia: a community-based cross-sectional study. *BMC nutrition*, *9*(1), 1-16.