Received: 22 December 2020 | Revised: 30 March 2021 | Accepted: 7 April 2021

DOI: 10.1111/mcn.13198

ORIGINAL ARTICLE

Maternal & Child Nutrition WILEY

Factors associated with adverse nutritional status of children in sub-Saharan Africa: Evidence from the Demographic and Health Surveys from 31 countries

Sulaimon T. Adedokun[1] | **Sanni Yaya**[2]

[1]Department of Demography and Social Statistics, Obafemi Awolowo University, Ile-Ife, Nigeria

[2]Faculty of Medicine, University of Parakou, Parakou, Benin

Correspondence
Sanni Yaya, Faculty of Medicine, University of Parakou, BP 123, Parakou, Benin.
Email: sanni.yaya@gmail.com

Abstract

Undernutrition is linked to almost half of all deaths in under-five children. In 2019, 144 million under-five children suffered from stunting and 47 million suffered from wasting. This study examined the factors that influence adverse nutritional status of children in sub-Saharan Africa. The study used data from the Demographic and Health Surveys (DHS) of 31 countries, which involved 189,195 children under age 5. Binary logistic regression was used to examine the relationships between the independent variables and adverse nutritional status of children. About 26% of the children in the 31 countries in sub-Saharan Africa considered in this study are stunted, 6% are wasted and 21% are underweight. Close to 31% of children whose mothers have no education are stunted, 9% are wasted and 28% are underweight. Adverse nutritional status of children is significantly associated with maternal age, education, household wealth, residence, antenatal care attendance, mass media exposure, child's sex and size of child at birth. This study has shown that adverse nutritional status of children is a major challenge in sub-Saharan Africa. Efforts at improving nutritional status of children should include poverty alleviation initiatives at individual and household levels, increase in women's educational level and improvement in living conditions in rural areas.

KEYWORDS
Africa, children, nutritional status, stunting, sub-Saharan, underweight, wasting

1 | INTRODUCTION

Malnutrition, which comprises undernutrition and overnutrition, is one of the major health challenges among children particularly in low- and middle-income countries (World Health Organization [WHO], 2020). Almost half of all deaths in under-five children are linked to undernutrition (United Nations Children's Fund [UNICEF], 2020). Undernutrition exposes children to the risk of dying from common infections and also contributes to the increase in the frequency and severity of such infections (UNICEF, 2020). In 2019, 144 million under-five children suffered from stunting while 47 million suffered from wasting (UNICEF, 2020). The phenomenon of undernutrition is more pronounced in some regions of the world than others. In 2019, while three regions (South Asia, East and Southern Africa and West and Central Africa) had the highest prevalence of stunted children, South Asia and sub-Saharan Africa as a whole had more than half and one-quarter of the global wasted children, respectively (UNICEF, 2020).

Efforts have been made, however, at the global level to address the problem of malnutrition. For instance, in 2016, the United Nations (UN) General Assembly proclaimed 2016–2025 the UN Decade of Action on Nutrition. This Action on Nutrition emphasizes policy action on the following areas: (i) creating sustainable and resilient food systems for healthy diets, (ii) providing social protection and nutrition related education for all, (iii) aligning health systems to nutrition needs and providing universal coverage of essential nutrition interventions, (iv) ensuring that trade and investment policies improve nutrition, (v) building safe and supportive environments for nutrition at all ages, and (vi) strengthening and promoting nutrition governance and accountability (WHO, 2020).

Despite these efforts, more children continue to suffer from stunting, wasting and underweight. Some factors influence this adverse nutritional status of children, and these have been identified in previous studies. For instance, while some studies attributed low household wealth, maternal education and the absence of antenatal care follow-up to the phenomenon (Amare et al., 2016), others identified family size, sex of child, immunization status, age of child and episode of diarrhoea as its determinants (Gebre et al., 2019). Other factors also highlighted in some studies include birth order, child's size at birth, breastfeeding, dietary diversity score, family income, and developmental delay (Kang & Kim, 2019; Nzefa et al., 2019; Omondi & Kirabira, 2016; Tette et al., 2015).

Most of these studies are country based with little attention given to a multicountry approach. This implies that a multicountry approach to examining the factors associated with adverse nutritional status of children in sub-Saharan Africa is underexplored. More so, this study is necessary when the implications of undernutrition among children are considered. Evidence has shown that the implications of undernutrition include impaired brain development, weakened immune system, small stature, greater risks of diseases, premature death and lost productivity and health care costs (The Power of Nutrition, 2021). In view of this, the objectives of this study are to (i) assess the prevalence of stunting, wasting and underweight among children and (ii) examine the factors that are associated with this adverse nutritional status among children in sub-Saharan Africa.

Key messages

- Child undernutrition remains a major health challenge in low- and middle-income countries.
- We identified factors that influence nutritional status of children in sub-Saharan Africa using a single analytical framework.
- Children of women aged 15–24 years are more likely to experience adverse nutritional outcomes compared with children whose mothers are 25 years and older.
- Education also plays an important role in child nutritional status.
- Improvements in nutritional status of children in the subregion would require intense efforts on alleviating poverty at individual and household levels.

2 | MATERIALS AND METHODS

2.1 | Study design

The data used in this study were obtained from the Demographic and Health Surveys (DHS) of 31 countries in sub-Saharan Africa. These are secondary data. The surveys are cross-sectional, conducted at intervals of at least 5 years and provide information on health and population characteristics. The countries involved in the study were selected on the basis of their most recent surveys. The surveys covered periods between 2010 and 2018 and involved 189,195 under-five children. The data for the 31 countries were aggregated to have a single data set for sub-Saharan Africa.

2.2 | Sampling technique

Multistage cluster sampling technique was used to select samples for the surveys. The first stage involved the application of primary sampling unit (PSU), which divided each country into clusters. These clusters were selected on the basis of probability that is proportional to the overall contribution of such clusters to the population. In the second stage, households were selected from each cluster. In each household, eligible respondents consisting of women aged 15–49 years who were either residents in the household or visitors present in the household at the time of the survey were interviewed (United States Agency for International Development [USAID], 2021). In this study, children aged 0–59 months were selected. The information about these children was obtained from their mothers.

2.3 | Data collection

Data collection exercise was carried out using standardized questionnaires, which covered issues such as socio-demographic characteristics, antenatal, delivery and postnatal care, maternal and child nutrition, immunization, domestic violence and reproductive history. A face-to-face interview with women of reproductive age was conducted by interviewers who recorded every response in the questionnaires (USAID, 2021).

2.4 | Outcome variable

The outcome variable in this study is adverse nutritional status (which is also referred to as adverse nutritional outcomes) of under-five children, which has been measured by three indicators. The indicators include stunting, wasting and underweight. These indicators are

anthropometric *z* scores that were assigned according to the WHO Child Growth Standards (WHO Multicentre Growth Reference Study Group, 2006). Stunting is defined as height-for-age *z* score less than −2.0 standard deviation from the median of the reference population. Wasting is defined as weight-for-height *z* score less than −2.0 standard deviation from the median of the reference population. Underweight is defined as weight-for-age *z* score less than −2.0 standard deviation from the median of the reference population.

2.5 | Independent variables

This study considered the following independent variables: maternal age, education, household wealth, residence, media exposure, antenatal care attendance, sex of child, child's age, child's size at birth, source of water, type of toilet facility and child's stool disposal. Maternal age was measured as 15–24, 25–34 and 35 years and above. Education has three categories, namely, no education, primary and secondary or higher. Household wealth was defined as poorest, poorer, middle, richer and richest. Household wealth is a variable that was obtained by awarding scores to items owned by each household. Such items include television, radio, bicycle, car, agricultural land and animals and housing facilities such as toilet, water source and roofing/flooring materials. The scores were aggregated and finally expressed in five quintiles as poorest, poorer, middle, richer and richest. Residence was divided into urban and rural. Media exposure was grouped into not exposed and exposed. Antenatal care attendance was defined as never attended and attended. Child sex was defined as male and female. Child's age was categorized as less than 12, 12–23 and 24–59 months. Child's size at birth was measured as large, average and small. Source of water and type of toilet facility were defined as improved and nonimproved. Child's stool disposal was defined as unsafe disposal and safe disposal.

2.6 | Ethical consideration

Ethical permissions were not required for this study because we used DHS dataset, which is already publicly available.

2.7 | Statistical analysis

Analysis of data in this study involved both descriptive and inferential statistics. At the descriptive level, numbers and percentages were used to describe the outcome and independent variables.. In order to ensure that the data are free from underenumeration and over-enumeration errors, a weighting factor was applied to each country's data before pooling all the data together to have a single data set for sub-Saharan Africa. At the multivariable level, binary logistic regression was applied to the dichotomous outcome variables. Three different logistic regressions were conducted using the three outcome variables. One logistic regression has stunting as the outcome and was coded as 1 for children who are stunted and 0 for those who are not stunted. The second logistic regression has wasting as the outcome and was coded as 1 for children who are wasted and 0 for children who are not wasted. The third logistic regression has underweight as the outcome and was coded as 1 for children who are suffering from underweight and 0 for those who are not suffering from underweight. Odds ratios, confidence intervals and corresponding *p* values defined at 0.05, 0.01 and 0.001 were thereafter obtained. All statistical operations were carried out using Stata 14 statistical software (StataCorp, 2015).

3 | RESULTS

3.1 | Descriptive statistics

Table 1 shows that countries with the highest prevalence of stunted children are Burundi (46.7%), Democratic Republic of Congo (36.3%) and Chad (35.6%). Countries with the highest prevalence of children suffering from wasting include Niger (13.7%), Burkina Faso (13.1%) and Chad (11.1%), where countries with the highest prevalence of underweight children are Niger (34.8%), Burundi (34.6%) and Chad (34.3%). In Table 2, it is revealed that about 26% of children in sub-Saharan Africa are stunted, 6% are wasted and 21% are underweight. Adverse nutritional outcomes are most pronounced among children whose mothers have no education. About 31% of children whose mothers have no education are stunted, 9% are wasted and 28% are underweight. Results also show that household wealth is inversely related to adverse nutritional status of children. Most children from poorest households are stunted (32%), wasted (8%) and underweight (26%). The proportions of children who experience adverse nutritional outcomes in a rural area are higher than that in an urban area. In the rural area, 29% of the children are suffering from stunting, 7% are suffering from wasting and 23% are underweight. With respect to media exposure, 32% of children whose mothers are not exposed to media are stunted, 8% are wasted and 27% are underweight. There is a higher prevalence of stunting (27%), wasting (7%) and underweight (21%) among boys than girls with 25%, 6% and 20%, respectively. Adverse nutritional outcomes are most prevalent among children who are 12–23 months old as 32% of these children are stunted, 11% are wasted and 28% are underweight. The relationship between the child's size at birth and adverse nutritional outcomes shows that 33% of children who were small at birth are stunted, 9% are wasted and 31% are underweight. The results further show that 30% of children whose households consume water from nonimproved source are suffering from stunting, 7% are suffering from wasting and 24% are underweight.

3.2 | Multivariable analysis

Table 3 shows the results from binary logistic regression revealing the factors associated with adverse nutritional status of children.

TABLE 1 Prevalence of stunting, wasting and underweight of children in sub-Saharan Africa

Country	Year of survey	Number of children	Adverse nutritional status		
			Stunted (%)	Wasted (%)	Underweight (%)
Angola	2015–2016	6765	29.1	4.2	21.2
Benin	2017–2018	12,256	24.0	4.3	19.9
Burkina Faso	2010	6837	28.0	13.1	28.3
Burundi	2016–2017	6096	46.7	4.0	34.6
Cameroon	2011	5286	25.6	4.4	16.2
Chad	2014–2015	10,775	35.6	11.5	34.3
Comoros	2012	2886	19.9	8.5	15.2
Congo	2011–2012	4621	21.3	4.7	16.5
Cote d'Ivoire	2011–2012	3488	21.7	5.8	17.6
Democratic Republic of Congo	2013–2014	8552	36.3	6.4	26.0
Ethiopia	2016	9696	28.3	10.0	27.6
Gabon	2012	3594	18.1	3.3	10.0
Gambia	2013	3640	17.8	8.8	19.6
Ghana	2014	2782	13.9	4.9	14.2
Guinea	2018	3582	23.6	7.4	18.6
Kenya	2014	19,334	20.5	5.0	16.7
Lesotho	2014	1381	26.2	2.9	14.1
Liberia	2013	3329	24.7	6.2	19.2
Malawi	2015–2016	5384	26.6	2.5	15.0
Mali	2018	8908	20.2	8.6	21.4
Namibia	2013	1945	17.1	7.2	16.3
Niger	2012	5576	29.9	13.7	34.8
Nigeria	2018	11,704	29.8	5.6	24.9
Rwanda	2014–2015	3615	31.0	1.7	11.5
Senegal	2010–2011	4323	20.1	7.5	20.2
South Africa	2016	1460	14.4	1.6	5.7
Tanzania	2015–2016	9213	26.0	4.2	17.4
Togo	2013–2014	3274	22.0	6.4	20.5
Uganda	2016	4530	21.9	3.3	12.9
Zambia	2018	9100	26.4	3.4	15.1
Zimbabwe	2015	5253	18.4	3.2	10.1

3.2.1 | Stunting

The results indicate that children whose mothers are 15–24 years old are 13% more likely to suffer from stunting than children whose mothers are 35 years and above. The chances of suffering from stunting increased by 53% and 42%, respectively, for children whose mothers have no education and those with primary education. Children from poorest and poorer households are 71% and 59%, respectively, more likely to experience stunting compared with children from richest households. Children from rural areas are 19% more likely to experience stunting compared with children from urban areas. The odds of experiencing stunting increased by 25% and 83%, respectively, for children who were of average size at birth and those who were small at birth. While the odds of suffering from stunting decreased by 75% for children who are less than 12 months, it increased by 12% for children who are 12–23 months old. Children whose mothers are not exposed to media are 29% more likely to experience stunting compared with children whose mothers had media exposure. The chances of experiencing stunting reduced by 21% for female children.

3.2.2 | Wasting

Children whose mothers have no education and those with primary education are 84% and 15%, respectively, more likely to suffer from wasting. While children whose mothers are not exposed to media are 11% more likely to suffer from wasting, those whose mothers did not

TABLE 2 Relationship between independent variables and adverse nutritional status of children in sub-Saharan Africa

	Stunted (*n* = 189,195)			Wasted (*n* = 189,195)			Underweight (*n* = 189,195)		
Variables	No *N* (%)	Yes *N* (%)	*p* value	No *N* (%)	Yes *N* (%)	*p* value	No *N* (%)	Yes *N* (%)	*p* value
Mother's age	140,115 (74.1)	49,080 (25.9)		177,456 (93.8)	11,739 (6.2)		149,819 (79.2)	39,376 (20.8)	
15–24	39,420 (74.4)	13,583 (25.6)		49,621 (93.6)	3382 (6.4)		42,247 (79.7)	10,756 (20.3)	
25–34	68,424 (74.3)	23,634 (25.7)		86,395 (93.8)	5663 (6.2)		72,916 (79.2)	19,142 (20.8)	
35+	32,271 (73.1)	11,863 (26.9)	<0.001	41,440 (93.9)	2694 (6.1)	0.133	34,656 (78.5)	9478 (21.5)	<0.001
Education									
None	53,739 (69.2)	23,867 (30.8)		70,840 (91.3)	6766 (8.7)		56,170 (72.4)	21,436 (27.6)	
Primary	46,615 (72.8)	17,460 (27.2)		61,115 (95.4)	2960 (4.6)		51,969 (81.1)	12,106 (18.9)	
Sec/higher	39,761 (83.7)	7,753 (16.3)	<0.001	45,501 (95.8)	2013 (4.2)	<0.001	41,680 (87.7)	5834 (12.3)	<0.001
Household wealth									
Poorest	34,148 (68.4)	15,775 (31.6)		46,197 (92.5)	3726 (7.5)		37,064 (74.2)	12,859 (25.8)	
Poorer	28,641 (70.1)	12,209 (29.9)		38,365 (93.9)	2485 (6.1)		31,498 (77.1)	9352 (22.9)	
Middle	26,640 (73.3)	9692 (26.7)		34,149 (94.0)	2183 (6.0)		28,825 (79.3)	7,507 (20.7)	
Richer	25,860 (77.8)	7381 (22.2)		31,308 (94.2)	1933 (5.8)		27,239 (81.9)	6002 (18.1)	
Richest	24,826 (86.1)	4023 (13.9)	<0.001	27,437 (95.1)	1412 (4.9)	<0.001	25,193 (87.3)	3656 (12.7)	<0.001
Residence									
Urban	46,719 (81.6)	10,505 (18.4)		54,295 (94.9)	2929 (5.1)		48,717 (85.1)	8507 (14.9)	
Rural	93,396 (70.8)	38,575 (29.2)	<0.001	123,161 (93.3)	8810 (6.7)	<0.001	101,102 (76.6)	30,869 (23.4)	<0.001
Media exposure									
Not exposed	48,407 (67.8)	22,945 (32.2)		65,846 (92.3)	5506 (7.7)		52,402 (73.4)	18,950 (26.6)	
Exposed	91,520 (77.9)	26,044 (22.1)	<0.001	111,359 (94.7)	6205 (5.3)	<0.001	97,215 (82.7)	20,349 (17.3)	<0.001
ANC attendance									
Never attended	11,657 (69.4)	5151 (30.6)		15,017 (89.3)	1791 (10.7)		11,863 (70.6)	4945 (29.4)	
Attended	90,260 (77.6)	25,983 (22.4)	<0.001	108,966 (93.7)	7277 (6.3)	<0.001	94,537 (81.3)	21,706 (18.7)	<0.001
Sex of child									
Male	69,449 (72.8)	25,942 (27.2)		88,939 (93.2)	6452 (6.8)		75,090 (78.7)	20,301 (21.3)	
Female	70,666 (75.3)	23,138 (24.7)	<0.001	88,517 (94.4)	5287 (5.6)	<0.001	74,729 (79.7)	19,075 (20.3)	<0.001
Child's age									
Less than 12 months	37,731 (89.7)	4318 (10.3)		39,769 (94.6)	2280 (5.4)		37,835 (90.0)	4214 (10.0)	
12–23 months	26,636 (68.0)	12,526 (32.0)		34,814 (88.9)	4348 (11.1)		28,071 (71.7)	11,091 (28.3)	
24–59 months	75,748 (70.2)	32,236 (29.8)	<0.001	102,873 (95.3)	5111 (4.7)	<0.001	83,913 (77.7)	24,071 (22.3)	<0.001

(Continues)

TABLE 2 (Continued)

Variables	Stunted (*n* = 189,195)			Wasted (*n* = 189,195)			Underweight (*n* = 189,195)		
	No *N* (%)	Yes *N* (%)	*p* value	No *N* (%)	Yes *N* (%)	*p* value	No *N* (%)	Yes *N* (%)	*p* value
Child's size at birth									
Large	47,272 (76.6)	14,405 (23.4)		58,623 (95.0)	3054 (5.0)		51,397 (83.3)	10,280 (16.7)	
Average	62,989 (74.0)	22,119 (26.0)		79,914 (93.9)	5194 (6.1)		67,397 (79.2)	17,711 (20.8)	
Small	19,714 (67.3)	9575 (32.7)	<0.001	26,548 (90.6)	2741 (9.4)	<0.001	20,265 (69.2)	9024 (30.8)	<0.001
Source of water									
Improved	92,581 (76.0)	29,153 (24.0)		114,436 (94.0)	7298 (6.0)		98,215 (80.7)	23,519 (19.3)	
Nonimproved	44,864 (70.0)	19,223 (30.0)	<0.001	59,783 (93.3)	4304 (6.7)	<0.001	48,748 (76.1)	15,339 (23.9)	<0.001
Type of toilet facility									
Improved	56,772 (79.2)	14,896 (20.8)		68,142 (95.1)	3526 (4.9)		60,237 (84.0)	11,431 (16.0)	
Nonimproved	80,674 (70.7)	33,478 (29.3)	<0.001	106,077 (92.9)	8075 (7.1)	<0.001	86,737 (76.0)	27,415 (24.0)	<0.001
Child's stool disposal									
Unsafe disposal	46,358 (72.5)	17,596 (27.5)		58,650 (91.7)	5304 (8.3)		48,364 (75.6)	15,590 (24.4)	
Safe disposal	55,830 (75.2)	18,432 (24.8)	<0.001	69,968 (94.2)	4294 (5.8)	<0.001	60,158 (81.0)	14,104 (19.0)	<0.001

attend antenatal care are 26% more likely to suffer from wasting. Female children are 24% less likely to suffer from wasting than male children. While children who are less than 12 months are 13% less likely to suffer from wasting, children who are 12–23 months old are 99% more likely to suffer from wasting. The odds of suffering from wasting increased by 28% and 73%, respectively, for children who were of average size at birth and those who were small at birth. Children from households with nonimproved toilet facility are 17% more likely to suffer from wasting. The odds of suffering from wasting increased by 27% for children from households that practice unsafe stool disposal.

3.2.3 | Underweight

Children whose mothers are 15–24 years old are 8% more likely to suffer from underweight compared with children whose mothers are 35 years and above. The odds of suffering from underweight increased by 104% and 39%, respectively, for children whose mothers have no education and those with primary education. The odds also increased by 18% and 19%, respectively, for children who are from poorest and poorer households. While children from rural area are 15% more likely to suffer from underweight, children whose mothers have no media exposure are 26% more likely to suffer from underweight. The odds of being underweight increased by 19% for children whose mothers did not attend antenatal care. While the chances of being underweight reduced by 68% for children who are less than 12 months, it increased by 26% for children who are 12–23 months old. Female children are 17% less likely to be underweight compared with male children. Children who were of average size at birth and those who were small at birth are 39% and 129%, respectively, more likely to experience underweight compared with children who were large at birth. The odds of suffering from underweight increased by 18% for children from households with nonimproved toilet facility and increased by 15% for children from households that practice unsafe stool disposal method.

4 | DISCUSSION

This study has revealed that 26% of children in the 31 countries in sub-Saharan Africa considered in this study are stunted, 6% are wasted and 21% are underweight. It also revealed the factors influencing adverse nutritional status of children. The results show that children of women aged 15–24 years are more likely to experience adverse nutritional outcomes compared with children whose mothers are 25 years and older. This indicates that there is preponderance of stunting, wasting and underweight among children of young women (Rachana et al., 2020; Wemakor et al., 2018; Yu et al., 2016). This may be attributed to the fact that young women are less experienced in childcare practices compared with their older counterparts. Education also plays an important role in child nutritional status. It is revealed in the study that children whose mothers have no education are more

TABLE 3 Results of binary logistic regression for adverse nutritional status of children in sub-Saharan Africa

Variables	Adverse nutritional status		
	Stunted aOR (95% CI)	Wasted aOR (95% CI)	Underweight aOR (95% CI)
Mother's age			
15–24	1.13*** (1.06–1.19)	1.01 (0.92–1.11)	1.08** (1.02–1.15)
25–34	0.99 (0.94–1.05)	0.99 (0.92–1.08)	1.02 (0.97–1.08)
35+	1	1	1
Education			
No education	1.53*** (1.44–1.63)	1.84*** (1.66–2.04)	2.04*** (1.91–2.20)
Primary	1.42*** (1.34–1.51)	1.15* (1.03–1.29)	1.39*** (1.30–1.49)
Secondary/higher	1	1	1
Household wealth index			
Poorest	1.71*** (1.55–1.89)	0.91 (0.79–1.05)	1.18** (1.07–1.30)
Poorer	1.59*** (1.45–1.75)	0.89 (0.78–1.02)	1.19** (1.08–1.31)
Middle	1.50*** (1.37–1.65)	0.94 (0.82–1.07)	1.16** (1.06–1.28)
Richer	1.47*** (1.34–1.59)	0.97 (0.86–1.10)	1.14** (1.04–1.25)
Richest	1	1	1
Residence			
Urban	1	1	1
Rural	1.19*** (1.12–1.27)	1.04 (0.95–1.14)	1.15*** (1.08–1.24)
Media exposure			
Never exposed	1.29*** (1.24–1.36)	1.11** (1.04–1.19)	1.26*** (1.19–1.32)
Exposed	1	1	1
ANC attendance			
Never attended	1.09** (1.03–1.17)	1.26*** (1.16–1.37)	1.19*** (1.12–1.27)
Attended	1	1	1
Sex of child			
Male	1	1	1
Female	0.79*** (0.76–0.83)	0.76*** (0.72–0.81)	0.83*** (0.79–0.86)
Child's current age			
Less than 12 months	0.25*** (0.24–0.27)	0.87** (0.79–0.97)	0.32*** (0.30–0.34)
12–23 months	1.12*** (1.07–1.17)	1.99*** (1.83–2.18)	1.26*** (1.19–1.33)
24–59 months	1	1	1
Child's size at birth			
Large	1	1	1
Average	1.25*** (1.19–1.31)	1.28*** (1.19–1.38)	1.39*** (1.32–1.46)
Small	1.83*** (1.73–1.94)	1.73*** (1.58–1.89)	2.29*** (2.15–2.44)
Source of water			
Improved	1	1	1
Nonimproved	1.03 (0.99–1.08)	0.91* (0.85–0.98)	1.02 (0.97–1.07)
Type of toilet facility			
Improved	1	1	1
Nonimproved	1.05 (0.99–1.11)	1.17*** (1.08–1.28)	1.18*** (1.11–1.25)
Child's stool disposal			
Unsafe disposal	0.98 (0.94–1.03)	1.27*** (1.18–1.36)	1.15*** (1.09–1.21)
Safe disposal	1	1	1

Abbreviations: aOR, adjusted odds ratio; CI, confidence interval.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

likely to experience adverse nutritional outcomes than children whose mothers have secondary or higher education. This implies that the higher the level of education of women, the less the incidence of adverse nutritional outcomes among their children (Dessie et al., 2019; Gea-Horta et al., 2016; Nankinga et al., 2019). Educated women are more enlightened and exposed in terms of information relating to child health. They also have the advantage of laying their hands-on materials, which highlight methods of improving child's nutritional status.

Household wealth is another factor that contributes significantly to adverse nutritional status of children. Children from poorest and poorer households have higher chances of being stunted, wasted and underweight compared with children from richest households (Ahsan et al., 2017; Kasaye et al., 2019). Poverty exerts negative impacts on child's nutrition as poor households lack the monetary ability to procure and consume foods that are rich in minerals and vitamins that promote good health among children. Children from rich households, on the other hand, have access to such foods, which contribute immensely to their growth and development. The significant effects of residence on adverse nutritional outcomes among children is emphasized in the study as children in rural area are more exposed to the risk of stunting, wasting and underweight than children in urban area (Alaofe & Asaolu, 2019; Senbanjo et al., 2016). Mothers of children in rural areas may not have access to information on child nutrition the same way women in urban areas do. At the same time, the living condition in urban areas is better than that in rural areas, hence the lower chances of adverse nutritional outcomes for children in urban areas.

The results further show that exposure to mass media is an important predictor of adverse nutritional outcomes among children (Chauhan et al., 2019; Khadse & Chaurasia, 2020). Children whose mothers never had media exposure are more likely to suffer from stunting, wasting and underweight. Access to information plays a significant role in child health. Exposure to media provides women with the opportunity of obtaining information on child nutrition. This seems to be the case when programmes relating to maternal and childcare are hosted on radio and television. In some cases, such programmes offer question and answer segments where women seek clarifications on maternal and child health issues. In this regard, women who are exposed to such programmes are better informed than their counterparts who lack such exposure. Antenatal care attendance also contributes significantly to adverse nutritional outcomes of children as children whose mothers did not attend antenatal care have higher probability of being stunted, wasted and underweight compared with whose mothers attended antenatal care (Hamel et al., 2015; Toma et al., 2018). Antenatal care attendance offers women the opportunity of obtaining adequate and authentic information not only on prenatal issues but also on delivery and postnatal issues.

However, results reveal that female children have lower likelihood of experiencing adverse nutritional outcomes compared with male children (Jawaregowda & Angadi, 2015; Jose, 2017). Findings in respect of child's age show that while children who are less than 12 months have lower tendency of experiencing stunting, wasting and underweight, children who are 12–23 months old have higher probability of experiencing these adverse nutritional outcomes. This implies that child's age is an important determinant of adverse nutritional outcomes (Habyarimana et al., 2016; Kinyoki et al., 2017). Relationship between child's size at birth and adverse nutritional outcomes reveals that children who were of average size at birth and those who were small at birth are more likely to suffer from stunting, wasting and underweight compared with children who were large at birth (Khan et al., 2019; Mohseni et al., 2017). This may be premised on the assumption that the conditions of the average-sized and small-sized children did not improve as they grew older probably due to the lack of nutritious diet. Toilet facility and child's stool disposal system exert influence on adverse nutritional outcomes of children as children from households with nonimproved toilet facility and those from households with poor child's disposal system are more exposed to the risk of wasting and underweight (Hall et al., 2020; Rahman et al., 2020; van Cooten et al., 2018). Nonimproved toilet facility together with poor stool disposal system may predispose children to infections, which could eventually lead to morbidity.

4.1 | Strengths and weaknesses

It should be emphasized that this study has some shortcomings based on the data sets used. The study used data of surveys conducted at different periods, and this makes efforts at harmonizing changes in population characteristics over such periods difficult. Also, most of the questions asked during the surveys relate to events that occurred within 5 years previously of conducting the surveys. Recalling such events on the part of the respondents might give room for errors, which could have influenced the final data. Despite these shortcomings, the study has provided robust findings from pooled data sets of 31 countries in sub-Saharan Africa using a single analytical framework. Based on the cross-sectional nature of the data, the findings from the study can be generalized to other developing regions.

5 | CONCLUSION

The study has revealed the magnitude of adverse nutritional outcomes among under-five children in 31 countries in sub-Sharan Africa. It showed that one quarter of the children are stunted, one fifth are wasted and 6% are underweight. The factors that precipitated these adverse nutritional outcomes include maternal age, education, household wealth, residence, media exposure, antenatal care attendance, child's sex, child's size at birth, toilet facility and child's stool disposal system. In view of this, improvements in nutritional status of children in the sub-Saharan Africa would require intense efforts on alleviating poverty at individual and household levels, increasing women's educational level, improving living conditions in rural areas, increasing proportions of women that attend antenatal care during pregnancy and increasing awareness on what constitutes adequate child nutrition among women of reproductive age.

ACKNOWLEDGMENTS

The authors thank the MEASURE DHS project for their support and for free access to the original data. The authors received no specific funding for this work.

CONFLICTS OF INTEREST

The authors declare that they have no competing interest.

CONTRIBUTIONS

STA and SY conceptualized and designed the study, STA acquired, analysed and interpreted the data, STA and SY drafted and revised the manuscript, SY critically reviewed the manuscript. SY had final responsibility to submit for publication. Both authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

DATA AVAILABILITY STATEMENT

Data for this study were sourced from the Demographic and Health surveys (DHS) and are available here: http://dhsprogram.com/data/available-datasets.cfm.

ORCID

Sulaimon T. Adedokun https://orcid.org/0000-0003-0021-8045

REFERENCES

Ahsan, K. Z., Arifeen, S. E., Al-Mamun, M. A., Khan, S. H., & Chakraborty, N. (2017). Effects of individual, household and community characteristics on child nutritional status in the slums of urban Bangladesh. *Archives of Public Health*, *75*(9), 1–13.

Alaofe, H., & Asaolu, I. (2019). Maternal and child nutrition status in rural communities of Kalale District, Benin: The relationship and risk factors. *Food and Nutrition Bulletin*, *40*(1), 56–70. https://doi.org/10.1177/0379572118825163

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*, 1–8. https://doi.org/10.1155/2016/7145708

Chauhan, B. G., Chauhan, S., & Chaurasia, H. (2019). Decomposing the gap in child malnutrition between poor and non-poor in Sierra Leone. *Journal of Public Health*, *27*, 119–127. https://doi.org/10.1007/s10389-018-0924-6

Dessie, Z. B., Fentie, M., Abebe, Z., Ayele, T. A., & Muchie, K. F. (2019). Maternal characteristics and nutritional status among 6–59 months of children in Ethiopia: Further analysis of Demographic and Health Survey. *BMC Pediatrics*, *19*(83), 1–10.

Gea-Horta, T., Felisbino-Mendes, M. S., Ortiz, R. J. F., & Velasquez-Melendez, G. V. (2016). Association between maternal socioeconomic factors and nutritional outcomes in children under 5 years of age. *Journal de Pediatria*, *92*(6), 574–580. https://doi.org/10.1016/j.jped.2016.02.010

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*, *2020*, 1–13.

Habyarimana, F., Zewotir, T., & Ramroop, S. (2016). Key determinants of malnutrition of children under five years of age in Rwanda: Simultaneous measurement of three anthropometric indices. *African Population Studies*, *30*(2).

Hall, J., Walton, M., Ogtrop, F. V., 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), 1–10.

Hamel, C., Enne, J., Omer, K., Ayara, N., Yarima, Y., Cockcroft, A., & Andersson, N. (2015). Childhood malnutrition is associated with maternal care during pregnancy and childbirth: A cross-sectional study in Bauchi and Cross River States, Nigeria. *Journal of Public Health Research*, *4*(408), 1–7.

Jawaregowda, S. K., & Angadi, M. M. (2015). Gender differences in nutritional status among under five children in rural areas of Bijapur District, Karnataka, India. *International Journal of Community Medicine and Public Health*, *2*(4), 1–4.

Jose, S. (2017). Decomposition of gender differential in malnutrition in Indian children. *Journal of Social and Economic Development*, *19*, 299–322. https://doi.org/10.1007/s40847-017-0047-x

Kang, Y., & Kim, J. (2019). Risk factors for undernutrition among children 0–59 months of age in Myanmar. *Maternal & Child Nutrition*, *2019*, 1–13.

Kasaye, H. B., Bobo, F. T., Yilma, M. T., & Woldie, M. (2019). Poor nutrition for under-five children from poor households in Ethiopia: Evidence from 2016 Demographic and Health Survey. *PLoS One*, *14*(2), 1–16.

Khadse, R. P., & Chaurasia, H. (2020). Nutrition status and inequality among children in different geographical regions of Maharashtra, India. *Clinical Epidemiology and Global Health*, *8*, 128–137. https://doi.org/10.1016/j.cegh.2019.05.008

Khan, S., Zaheer, S., & Safdar, N. F. (2019). Determinants of stunting, underweight and wasting among children <5 years of age: Evidence from 2010–2013 Pakistan Demographic and Health Survey. *BMC Public Health*, *19*(358), 358. https://doi.org/10.1186/s12889-019-6688-2

Kinyoki, D. K., Manda, S. O., Moloney, G. M., Odundo, E. O., Berkley, J. A., Noor, A. M., & Kandala, N. B. (2017). Modelling the ecological comorbidity of acute respiratory infection, diarrhoea and stunting among children under the age of 5 years in Somalia. *International Statistical Review*, *85*(1), 164–176. https://doi.org/10.1111/insr.12206

Mohseni, M., Aryankhesal, A., & Kalantan, N. (2017). Factors associated with malnutrition among under-five-year children in Iran: A systematic review. *Annals Tropical Medicine and Public Health*, *10*(5).

Nankinga, O., Kwagala, B., & Walakira, E. J. (2019). Maternal employment and child nutritional status. *PLoS One*, *14*(2), 1–14.

Nzefa, L. D., Monebenimp, F., & Ang, C. (2019). Undernutrition among under five in the Bandja Village of Cameroon, Africa. *South African Journal of Clinical Nutrition*, *32*(2), 1–6.

Omondi, D. O., & Kirabira, P. (2016). Socio-demographic factors influencing nutritional status children (6–59 months) in Obunga Slums, Kisumu City, Kenya. *Public Health Research*, *6*(2), 69–75.

Rachana, R. D., Prashanth, M. R., & Savitha, M. R. (2020). Maternal risk factors in malnourished children: A neglected study. *Sri Lanka Journal of Child Health*, *49*(2), 151–155.

Rahman, M. H. U., Malik, M. A., Chauhan, S., Patel, R., Singh, A., & Mittal, A. (2020). Examining the linkage between open defecation and child malnutrition in India. *Children and Youth Services Review*, *117*, 105345. https://doi.org/10.1016/j.childyouth.2020.105345

Senbanjo, I. O., Olayiwola, I. O., & Afolabi, W. A. (2016). Dietary practices and nutritional status of under-five children in rural and urban communities of Lagos State, Nigeria. *Nigerian Medical Journal*, *57*(6), 307–313. https://doi.org/10.4103/0300-1652.193854

StataCorp. (2015). *Stata statistics software*. College Station, TX: StataCorp LP.

Tette, E. M. A., Sifah, E. K., & Nartey, E. T. (2015). Factors affecting malnutrition and the uptake of interventions to prevent the condition. *BMC Pediatrics*, *15*(189), 1–11.

The Power of Nutrition. (2021). Impact of Stunting. https://www.powerofnutrition.org/the-impact-of-stunting/#:~:text=Stunting%20not%20only%20affects%20a,and%20cognitive%20potentials%20as%20adults. Accessed 20 March 2021

Toma, A. S., Talukder, A., Khan, S. S., & Razu, S. R. (2018). An assessment of the association between antenatal care and child malnutrition in Bangladesh. *Family Medicine and Primary Care Review*, *20*(4), 373–378. https://doi.org/10.5114/fmpcr.2018.79350

UNICEF. (2020). Malnutrition. https://data.unicef.org/topic/nutrition/malnutrition/. Accessed 31 October 2020

USAID. (2021). The DHS Program. https://dhsprogram.com/data/available-datasets.cfm. Accessed 20 March 2021

van Cooten, M. H., Bilal, S. M., Gebremedhin, S., & Spigt, M. (2018). The association between acute malnutrition and water, sanitation, and hygiene among children aged 6–59 months in rural Ethiopia. *Maternal & Child Nutrition*, *15*(1).

Wemakor, A., Garti, H., Azongo, T., Garti, H., & Atosona, A. (2018). Young maternal age is a risk factor for child undernutrition in Tamale Metropolis, Ghana. *BMC Research Notes*, *11*(877), 1–5.

WHO. (2020). Malnutrition: Key Facts. https://www.who.int/news-room/fact-sheets/detail/malnutrition. Accessed 31 October 2020

WHO Multicentre Growth Reference Study Group. (2006). *WHO Child Growth Standards: Length/Height-for-Age, Weight-for-Age, Weight-for-Length, Weight-for-Height and Body Mass Index-for-Age: Methods and Development*. Geneva, Switzerland. https://www.who.int/childgrowth/publications/technical_report_pub/en/

Yu, S. H., Mason, J., Crum, J., Cappa, C., & Hotchkiss, D. R. (2016). Differential effects of young maternal age on child growth. *Global Health Action*, *9*, 1–13.

How to cite this article: Adedokun ST, Yaya S. Factors associated with adverse nutritional status of children in sub-Saharan Africa: Evidence from the Demographic and Health Surveys from 31 countries. *Matern Child Nutr*. 2021;17: e13198. https://doi.org/10.1111/mcn.13198