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Determinants of under-five malnutrition, significant changes, and policy implications in the Ethiopian Demographic Health Survey, 2019

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Abstract
This study, which used data from the 2019 mini DHS, was to look at the determinants of under-five malnutrition, policy implications, and significant changes in the Ethiopian demographic survey between 2016 and 2019 concerning its determinant factors. This data is the fifth and latest demographic and health survey in Ethiopia, conducted from March 21, 2019, to June 28, 2019. The EDHS 2019 interviewed 9012 women, but only 8885 completed the questionnaire. This EDHS provides a detailed examination of Ethiopia's overall population, child health, and maternal issues using a cross-sectional study design. The results showed that 24–35 (AOR = 4.11, 95% CI [2.13, 7.94]) and 12–17-month-old children faced severe stunting more than three times as often compared to children who were less than eleven months old (AOR = 3.11, 95% CI [1.13, 7.94]). The problem of child wasting was also highly severe in Ethiopian-Somalia and Gambela, with 32% in both. Children in these regions were two or three times more vulnerable to wasting compared to the other areas (AOR = 3.42, 95% CI [0.42–0.55]) and (AOR = 2.99, 95% CI [0.75–1.57]). This study found that stunting prevalence increased by 22% among children aged 6–8 months and by 44% among children aged 48–59 months. Nonetheless, the highest rate (45%) of stunting, wasting, and underweight was observed in children aged 24–35 months, and it was significantly higher in males (40%) than in females (33%). Comparatively, the Ethiopian Demographic Health Survey of 2019 showed a slight reduction in the problems of stunting, wasting, and underweight issues among children under five, at 37%. Still, based on the findings, the authors recommend that multi-factor treatments be used to address the nutritional condition of children. By providing essential services, policy measures that reduce the impact of undernutrition may be implemented to increase access to health care. Moreover, this study recommends the federal government pay attention to children's well-being above 24 months, and it might be resolved through the Agricultural Development Led Industrialization (ADLI) strategy and related food security initiatives.

Keywords Stunting · Under-weight · Wasting · Children · EDHS

1 Introduction

Malnutrition among under-five children is one of the most crucial public health issues, causing morbidity and mortality and accounting for almost 45% of total deaths among children under 5 years of age [1]. As indicated in different studies, child malnutrition affects both children's physical and mental development, and its impact crosses into adulthood [2–4]. The continuing malnutrition situation among children can create long-term consequences

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for different aspects of the child's life. It can affect their physical growth, lower their intellectual ability, lead to poor cognitive abilities, affect productivity, create reproductive health problems, and lower school performance with deviant behaviors and fewer social skills [1, 2].

Globally, in 2020, more than 149.2 million under-five children suffered from stunting, 45.4 million were wasted, and more than 38.9 million were underweight [5]. At 55%, Asia has the most significant number of undernourished people globally, followed by Africa at 39%. Furthermore, the number of wasted children under five in Africa is relatively low (27%), compared to 69% in Asia [6, 7].

The SDGs demand that all governments implement an integrated transformation over the next 15 years to decrease under-five mortality, eradicate hunger and enhance maternal health, which is critical for increasing child survival prospects [8]. In 2018, UNICEF, WHO, and the World Bank conducted research on malnutrition among under-five children in African countries. According to a study conducted in 3 African countries, a high stunting prevalence of 36.4%, 28.8%, and 28.7% was reported in Niger, Chad, and Nigeria, respectively [4, 9]. Based on the reports of WHO and UNICEF in 2018, among East African studies, Ethiopia has high wasting and is underweight with 8.7% and 25.2%, respectively [3, 10].

Compared to the other regional governments and municipal administrations in Ethiopia, the Tigray area has a high rate of stunting, underweight, and wasting among children. In the Tigray region, 39.2% of under-five children are stunted, 23% are malnourished, and 11.1% are wasted. Based on the Ethiopian demographic and health survey in 2016, 13.4% of those under five were severely stunted, 3.4% had severe wasting, and 5.20% were hardly underweight [3].

Although several studies have been conducted on identifying factors associated with under-5 stunting, wasting, and underweight in Ethiopia, none of them uses the new DHS data released in 2019 [10–13]. One of the gaps this study tried to fill is that we tried to compare the changes made since the 2016 DHS data by comparing them with that of the 2019 EDHS dataset. Ethiopia's government has implemented different policies and measures to enhance children's nutritional conditions, mainly in rural areas. A favorable implication is that rural health extension workers spend 15% of their time with newborns and children under five. The Ethiopian-Seqota Declaration, the national food security strategy, the school-health nutrition strategy, and the nutrition-sensitive plan are some of the approaches and policies that the Ethiopian government has been using to reduce child undernutrition [14]. The 2016 Seqota Declaration, national food security policy, school health, and nutrition strategy, nutrition-sensitive strategy, and other national and regional policies and initiatives all emphasize children under the age of 24 months. This is because a baseline survey for this declaration found that 41% of children aged 6–23 months are stunted, wasted, and underweight. As a response to the results of the pilot study, they have paid more attention to children's first 1000 days. During the baseline research, the prevalence of stunting, wasting, and underweight was greater in children under 24 months than in children over 24 months. Although the problem of child malnutrition has been severe and varied from region to region in Ethiopia, the Seqota declaration was being piloted in only the Tigray and Amhara regions, which doesn't give enough concern to other geographical areas [14]. Besides, the Seqota declaration ensures universal access to nutritious food only for the first 1000 days of a window opportunity, from the start of pregnancy to a child's birthday, without emphasizing the second 1000 days. It implies the declaration neglects the need to reduce the malnutrition susceptibility and vulnerability of children in the second 2000 days.

According to the study by Zerihun et al. [9], while these initiatives have resulted in some good improvements, the intended amount of change has not been realized. The failure of these strategies is due to the fragmented lead approach, and it indicates insufficient multi-sectoral coordination in response to the population's food demand, particularly among children. Even though Ethiopia has progressed in reducing under-five stunting, wasting, and underweight when comparing 2016 and 2019 DHS data, a coordinated, efficient, and continuous effort is still required to reduce risk factors and have better health for further reduction. We need more studies to know the most critical risk factors for child stunting, wasting, and underweight children and inform policymakers to implement appropriate intervention programs. We conducted a cross-sectional analysis of the recent 2019 Ethiopian mini DHS to assess the risk factors for child stunting, wasting, and being underweight to address this gap. Using the 2019 mini DHS data, the central focus of this research was to analyze the risk variables related to child stunting, wasting, and underweight among Ethiopian under-five children.

1.1 The objective of the study

This study sought to assess the determinant for stunting, wasting, and underweight in Ethiopia using the Ethiopian Demographic Health Survey (2019) and to identify the significant changes from the Ethiopian Demographic Health Survey (2016). Moreover, the study tried to discuss the significant changes that happened in the Ethiopian demographic

health survey (2019) compared to the Ethiopian demographic health survey (2016). This study also recommended policy revisions and the development of a food and nutrition strategy for the second thousand days of children.

2 Methods

2.1 Study design and data set

The researchers obtained an official approval letter from an Ethiopian public health institution before performing this study. After receiving approval from the IRB (internal review board), the manuscript was critically assessed and authorized by the Wolkite University research center and Department of Sociology for study adherence (Ref No: SOCI/805/2022). This study's data relied on the Ethiopian Demographic Health Survey, 2019, and the data used in the study was obtained from EPHI (Ethiopian public health institution). This data is the fifth and latest demographic and health survey in Ethiopia, conducted from March 21, 2019, to June 28, 2019. This EDHS provides a detailed examination of Ethiopia's overall population, child health, and maternal issues using a cross-sectional study. The dataset of this study can be found from the measure of the DHS dataset at https://dhsprogram.com/pubs/pdf/FR363/FR363.pdf. The 2019 Ethiopian mini DHS selected its sample in two stages using probability proportional stratified sampling. Each of Ethiopia's nine regions was classified as urban or rural in the first stage, yielding 21 sampling quotas. The first stage has occurred in 305 enumeration areas across all nine Ethiopian regions (93 are urban and the remaining 212 are rural). The household listing was conducted from January to April 2019. In the second stage, 30 fixed numbers of households within each stratum were selected using probability proportional stratified sampling. And the enumeration areas were selected to have an equal chance of being selected from the household listings conducted in January-April 2019. In the meantime, to examine the nutritional status of children, the Ethiopian mini DHS 2019 used standardized questionnaires called the Women's questionnaire and the Anthropometry questionnaire. The women's questionnaires included all women whose ages ranged from 15-to 49. In addition, anthropometry questionnaires were also used to measure the height and weight of children from 0–to 59. In the anthropometry of children, the measurement of weight was gained through electronic SECA 874 scales with a digital screen and a mother-child function. The measurement of weight was obtained through measuring boards donated by UNICEF. Children under the age of 24 months were measured while lying down (recumbent) on the board, whereas older children were measured while standing. In this survey, women who were found in the listed households during the survey were eligible to be interviewed. The EDHS 2019 included all children whose mother was presented at the time of the survey as an inclusion criterion. All children whose mother is not listed in the household listing and questionnaire were excluded from the survey. During the interview, a total of 9012 women were selected for the interview, but only 8,885 women completed the questionnaire. The response rate in the urban areas was 98.4, and 98.7% in the rural areas.

2.2 Study variables and measurements

This study identified our variable as both an outcome variable and an explanatory variable. The outcome variable in the study was the nutritional status of the children. The nutritional status in this study was classified into three outcome groups, including height for age, weight for age, and weight for height. Anthropometric questionnaires assessed the nutritional status of children by looking at the children's age, height, and weight.

The height-for-age Z-score for stunted children is less than minus two standard deviations (– 2 SD) from the reference population median. If the child's weight-for-age Z-score is less than minus two standard deviations (– 2 SD) from the reference population's median, they are underweight. The weight-for-height Z-score of the considered wasted children is less than minus two standard deviations (– 2 SD) from the population median.

The explanatory variables were classified under seven demographic backgrounds of children. These demographic variables include age in months, sex, mother's interview status, residence region, mother's education, and wealth quintile. The age in month variables was measured from 0 to 59 months to look at the level of stunting at each stage of the month. The mother's interview status was also measured through two options: interviewed and not interviewed in the household. The non-interviewed mothers were not eligible for the survey. The residences of the respondents were identified as urban and rural. And the survey was undertaken in all regions found in Ethiopia (Tigray, Afar, Oromia, Amhara, Somali, Benishangul, SNNP, Addis Ababa, Harari, and Dire-Dawa). Finally, the wealth quintile was measured through five options; women and children were found in the lowest, second, middle, fourth, and highest classes.

2.3 Data analysis

This study used bivariate analysis to observe the associations between the outcome and explanatory variables using the X2 test. For the bivariate analysis, we used a multinomial regression model. We thought it was suitable to predict nominal dependent variables (stunting, wasting, and underweight child status) given one or more independent variables (age in months, sex, residence region, mother's education, and wealth quintile). The explanatory variables were significantly linked with the outcome variables through multivariable logistic regression models, resulting in an odds ratio with 95% confidence intervals. And the p-value was used to test the statistical significance of the predictors with a lower reference point than 0.05.

3 Results

3.1 Socio-demographic profile of the participants

The interviewed mother of child-participant socio-demographic variable in this study was obtained based on the three measurement categories that the EDHS 2019 classified as height-for-age is stunting, weight-for-age is underweight, and weight-for-height is wasting. In Table 1, in terms of child participants' age in months, the majority were between 36 and 47 months (HA, 22.1%; WH, 22.1%; WA, 21%). Based on the data, the majority were males (55.6%), and their mothers were interviewed 99.9%. Concerning the regional segregation, most of the participants in this study were from the Oromia region, and the percentage relied on was between 39 and 40% for the three measurements (HA, WH, and WA). Table 1 also shows that a significant number of child participants were from the lowest wealth quintile (HA, 22.9%; WH, 23.8%; and WA, 23.1%), and the status of the mother's education was uneducated (HA, 53.1, WH, 52.8, and 53.3%).

3.2 Determinants of stunting (height-for-age)

The data in Table 2 showed that age in months, sex, residence, region, mother's education, and wealth status of the mother are significant predictors of stunting (height for age). The results showed that compared with the age in months of children, 24–35 (AOR = 4.11, 95% CI [2.13, 7.94]), 36–47 (AOR = 6.59, 95% CI [5.00–8.68]), and 12–17 (AOR = 3.11, 95% CI [1.13, 7.94]) months of children faced severe stunting more than three times compared to the children who were less than eleven months old and those 18–23 months old. In terms of gender and location, male children living in rural areas are more than twice as likely to be stunted (AOR = 1.10, 95% CI [0.91, 1.32]) and (AOR = 1.86, 95% CI [0.69–1.07]). In terms of regions, the children from Amhara, Benishangul Gumuz, Gambella, Harari, and Dire-Dawa faced severe stunting more than once compared to the other remaining regions in Ethiopia. The data also showed that children of mothers who completed primary education (AOR = 0.82, 95% CI [0.66–1.11]) and in the second (poorer) household (AOR = 0.92, 95% CI [0.72–1.16]), were more than 0.8 times more affected by stunting than the other children.

3.3 Determinants of wasting (weight-for-height)

The same as with stunting. Data in Table 3 showed that age in months, sex, residence, region, mother's education, and the wealth status of the mother are significant predictors of weight loss (weight for height). The table also shows children whose age is less than six months and between the months of 12–17 and 36–47 faced a serious wasting problem more than three and five times (AOR = 4.04, 95% CI [1.64, 2.99]), (AOR = 3.31, 95% CI [1.33, 6.74]) and (AOR = 6.79, 95% CI [4.50–7.38]). In terms of place of residence and gender, the data showed the wasting problem was more than once for those who were male and resided in rural areas (AOR = 1.60, 95%CI [0.81, 1.22]) and (AOR = 1.96, 95% CI [0.65–1.27]). Regarding the regional level, the problem of wasting on under-five children was highly severe in Ethiopian-Somalia and Gambela. Children from these regions were two and three times more vulnerable to wasting compared to the other regions (AOR = 3.42, 95% CI [0.42–0.55]) and (AOR = 2.99, 95% CI [0.75–1.57]). The data also showed that the children whose mother's education ceased in primary education and less than primary education were facing a wasting problem than those whose mother had taken more than primary education (AOR = 0.82, 95% CI [0.66–1.11]). Finally, we have got the wealth quintile of the children's family as the major determinant factor. Meanwhile, the data showed that children from the lowest wealth quintile were influenced by stunting comparatively (AOR = 1.98, 95% CI [0.71–1.10]).

Table 1 Socio-demographic background of respondents

		Height-for-age		Weight-for-height		Weight-for-age	
		Number	%	Number	%	Number	%
Age in months	< 6	523	9.9	519	10.2	535	10.7
	6–8	265	5.02	254	5	252	5
	9–11	228	4.3	222	4.3	221	4.4
	12–17	567	10.7	548	10.3	549	11
	18–23	471	8.9	453	8.9	449	8.9
	24–35	1052	19.9	996	19.6	979	19.6
	36–47	1168	22.1	1074	21.2	1048	21
	48–59	1004	19	992	19.6	956	19.1
Sex	Male	2503	50.6	2567	50.7	2527	50.6
	Female	2434	50.4	2491	50.3	2463	50.4
Mother's interview status	Interviewed	4897	99.1	4953	97.9	4950	99.1
	Not-interviewed	40	0.8	104	2	40	0.8
Residence	Urban	1245	15.2	1256	24.8	1254	25.1
	Rural	3692	74.7	3801	75.1	3736	54.8
Region	Tigre	349	7	350	6.9	350	1
	Afar	75	1.5	77	1.5	76	1.5
	Amara	941	19	950	18.7	947	18.9
	Oromo	1974	39.9	2023	40	1998	40
	Ethiopian-Somalia	346	7	367	7.2	349	6.9
	Benishangul-Gumuz	59	1.1	60	1.1	60	1.2
	SNNP	996	20.1	1031	20.3	1007	20.1
	Gambela	20	0.4	21	0.4	21	0.4
	Harari	14	0.2	15	0.2	14	0.2
	Addis Ababa	137	2.7	138	2.7	142	2.8
	Dire-Dawa	26	0.5	26	0.5	26	0.5
Mother's education	No education	2626	53.1	2672	52.8	2660	53.3
	Primary education completed	1732	35	1742	34.4	1747	35
	Secondary education completed	360	7.2	361	7.1	362	7.2
	Above secondary	179	3.6	179	3.5	181	3.6
Wealth quintile	Lowest	1132	22.9	1207	23.8	1154	23.1
	Second	1063	21.5	1076	21.2	1074	21.5
	Middle	904	18.3	917	18.1	912	18.2
	Fourth	897	18.1	901	17.8	901	18
	Highest	942	19	955	18.8	950	19
Total		4937	100	5057	100	4990	100

3.4 Determinants of underweight (weight-for-age)

The EDHS data in Table 4 shows that children whose age is less than six months and between the months of 24–35 are four times affected by underweight (AOR = 4.44, 95% CI [1.76, 3.01]) and (AOR = 4.32, 95% CI [2.67, 7.88]) consecutively. And children between the ages of 36 and 47 were more than six times more likely to be underweight (AOR = 6.99, 95%CI [4.59–7.48]). In terms of children's place of residence and gender (sex), the data revealed that under-5 child underweight problems are especially difficult in rural areas and for male children, who are more vulnerable to underweight than any other group. Despite this, the underweight regional problem in Ethio-Somalia and Gambella has worsened. The data showed that children from these two regions were three times faced underweight (AOR = 3.54, 95% CI [0.54–0.77]) and twice underweight (AOR = 3.04, 95% CI [0.87–1.69]) consecutively. Furthermore, the problem of being underweight was more severe in the children of illiterate

Table 2 Table Logistic regression analysis on the determinants of stunting (height for age in Ethiopia related to the socio-demographic variables of respondents

Variables	Values	UOR	AOR	*P*-value
Age in months	< 6	1.75 (1.37, 2.25)	3.04 (1.44, 2.89)	0.002*
	6–8	0.67 (0.33, 1.32)	0.62 (0.36, 1.10)	0.001**
	9–11	0.50 (0.24, 1.07)	0.55 (0.31, 0.97)	0.001**
	12–17	3.94 (2.52, 4.67)	3.11 (1.13, 7.94)	0.000***
	18–23	2.53 (0.29, 8.04)	1.43 (0.47, 4.32)	0.001**
	24–35	2.94 (1.52, 5.67)	4.11 (2.13, 7.94)	0.000***
	36–47	5.59 (4.00–6.68)	6.59 (5.00–8.68)	0.000***
	48–59	1	1	1
Sex	Male	1.13 (0.97, 1.29)	1.10 (0.91, 1.32)	0.001**
	Female	1	1	1
Residence	Rural	0.96 (0.59–1.07)	1.86 (0.69–1.07)	0.001**
	Urban	1	1	1
Region	Tigre	1	1	1
	Afar	1.23 (0.97–1.81)	0.77 (0.69–1.10	0.002*
	Amara	0.77 (0.62–1.20)	1.67* (1.03–1.58)	0.001**
	Oromo	1.10 (0.65–1.34)	0.73 (0.78–1.01)	0.001**
	Ethiopian-Somalia	2.12 (1.51–2.68)	0.42 (0.52–0.65)	0.000***
	Benishangul-Gumuz	0.87 (0.59–1.37)	1.23 (0.80–1.43)	0.001**
	SNNP	0.89 (0.90–1.21)	0.70** (0.42–0.84)	0.000***
	Gambela	0.41 (0.29–0.66)	1.19 (0.74–1.67)	0.000***
	Harari	0.77 (0.57–1.15)	1.10 (0.71–1.76)	0.002*
	Addis Ababa	0.35** (0.17–0.76)	0.64* (0.43–0.94)	0.001**
	Dire-Dawa	0.73 (0.55–1.27)	1.19 (0.83–1.43)	0.001**
Mother's education	No education	0.87 (0.86–1.10)	0.72 (0.76–1.11)	0.000***
	Primary education completed	0.98 (0.76–1.10)	0.82 (0.66–1.11)	0.001**
	Secondary education completed	0.56 (0.52–0.84)	0.70 (0.67–1.13)	0.000***
	Above secondary	1	1	0.000***
Wealth quintile	Lowest	1.01 (0.86–1.17)	0.88 (0.71–1.10)	0.000***
	Second	0.77 (0.65–0.91)	0.92 (0.72–1.16)	0.001**
	Middle	0.69*** (0.58–0.82)	0.66** (0.50–0.87)	0.000***
	Fourth	0.62*** (0.49–0.79)	0.58** (0.40–0.83)	0.000***
	Highest	1	1	1

Source: EDHS, 2019

mothers who did not attend a formal education (AOR = 1.78, 05% CI [0.97–1.63]). In the end, the data in Table 4 shows that children from the second poorest and first poorest households were affected and faced one time more underweight than children from the middle and fourth wealth quintiles (AOR = 1.93, 95% CI [0.82–1.96]) and (AOR = 1.11, 95% CI [0.88–1.45]).

4 Discussions

This study seeks to investigate the determinants of under-five age, child stunting, wasting, and underweight issues in Ethiopia based on the Ethiopian mini demographic health survey, 2019. The study examines the determinants of height for age, weight for age, and weight for height using the multinomial logistic model. The explanatory variables were significantly linked with the outcome variables through multivariable logistic regression models, resulting in an odds ratio with 95% confidence intervals. And the p-value was used to test the statistical significance of the predictors with a lower reference point than 0.05. This study found that stunting prevalence increased by 22% among children aged 6–8 months and 44% among children aged 48–59 months. Nonetheless, the highest rate (45%) of stunting, wasting, and underweight was observed in children aged 24–35 months, and it was significantly higher in males (40%) than in females (33%). Over

Table 3 Table Logistic regression analysis on the determinants of (Weight-for-height) in Ethiopia related to the socio-demographic variables of respondents

		UOR	*AOR*	*P*-Value
Age in months	< 6	2.65 (2.37, 2.75)	4.04 (1.64, 2.99)	0.001**
	6–8	0.57 (0.44, 3.32)	0.72 (0.36, 1.40)	0.001**
	9–11	0.70 (0.27, 1.27)	0.65 (0.21, 0.97)	0.001**
	12–17	3.74 (2.32, 4.47)	3.31 (1.33, 6.74)	0.000***
	18–23	2.73 (1.29, 7.04)	1.53 (0.67, 4.22)	0.001**
	24–35	2.54 (1.72, 5.67)	4.21 (2.53, 7.84)	0.000***
	36–47	5.39 (4.25–6.78)	6.79 (4.50–7.38)	0.000***
	48–59	1	1	1
Sex	Male	2.13 (0.67, 1.69)	1.60 (0.81, 1.22)	0.000**
	Female	1	1	1
Residence	Rural	0.66 (0.79–2.07)	1.96 (0.65–1.27)	0.001**
	Urban	1	1	1
Region	Tigre	1	1	1
	Afar	1.53 (0.87–1.71)	0.57 (0.59–1.70)	0.002*
	Amara	0.78 (0.52–1.30)	1.67 (1.33–1.58)	0.000**
	Oromo	1.40 (0.75–1.44)	0.83 (0.68–1.31)	0.001**
	Ethiopian-Somalia	2.42 (1.41–2.58)	3.42 (0.42–0.55)	0.000***
	Benishangul-Gumuz	1.86 (0.69–1.47)	1.33 (0.70–1.63)	0.001**
	SNNP	0.99 (0.70–1.61)	1.70 (0.92–0.74)	0.000***
	Gambela	0.41 (0.29–0.66)	2.99 (0.75–1.57)	0.000***
	Harari	0.77 (0.57–1.15)	1.67 (0.76–1.92)	0.002*
	Addis Ababa	0.42 (0.23–0.82)	0.74 (0.55–1.11)	0.001**
	Dire-Dawa	0.93 (2.55–1.77)	1.69 (0.93–1.73)	0.001**
Mother's education	No education	0.97 (0.96–1.20)	0.82 (0.96–1.31)	0.000***
	Primary education completed	0.98 (0.76–1.10)	0.82 (0.66–1.11)	0.001**
	Secondary education completed	0.67 (0.55–0.94)	0.78 (0.87–1.63)	0.000***
	Above secondary	1	1	0.000***
Wealth quintile	Lowest	1.23 (0.86–1.27)	1.98 (0.71–1.10)	0.001***
	Second	0.77 (0.75–0.91)	0.93(0.72–1.16)	0.001**
	Middle	0.72 (0.58–0.82)	0.69 (0.70–0.87)	0.001***
	Fourth	0.87 (0.57–0.89)	0.58 (0.90–0.83)	0.000***
	Highest	1	1	1
Total				

Source: EDHS, 2019

the past two decades, food policy in Ethiopia has been concerned with fundamental economic programs and ensuring social and macroeconomic development [14]. For two decades, the food policy in Ethiopia primarily focused on providing food and nutrition security to children through economic reforms and putting the economy on a solid foundation [14]. Thus, to accelerate the country's overall economic growth, it is critical to use these possibilities and execute cost-effective food and nutrition security measures sustainably for children's wellbeing [15]. In contrast to Ethiopia's previous food and nutrition policy, the 2018 Ethiopian food and nutrition policy expands its dimensions to food and nutrition security, such as sustained food availability, accessibility, and utilization of food; food safety and quality; post-harvest management; and optimal nutrition security at all levels of society, agro-ecological zones, and livelihoods, as well as in recurring emergencies for children's [15]. Furthermore, the new Ethiopian food and nutrition policy in 2018 takes into account a variety of issues that pose challenges to children's food security and nutrition, such as land degradation, globalization, regional market integration, demographic change, income inequalities, increasing population pressure, urbanization, and the demand for natural resources. However, the lack of a legislative framework and an accountability structure for food and nutrition implementing sectors has caused food and nutrition security to fall behind expectations.

Table 4 Table Logistic regression analysis on the determinants of underweight (Weight-for-age) in Ethiopia related to the socio-demographic variables of respondents

		UOR	*AOR*	*P*-Value
Age in months	< 6	2.86 (2.45, 2.87)	4.44 (1.76, 3.01)	0.001**
	6–8	0.75 (0.54, 3.43)	0.81 (0.43, 1.56)	0.001**
	9–11	0.78 (0.33, 1.31)	0.71 (0.23, 1.03)	0.001**
	12–17	3.84 (2.39, 4.57)	3.34 (1.45, 6.82)	0.000***
	18–23	2.73 (1.39, 7.14)	1.65 (0.73, 4.45)	0.001**
	24–35	2.54 (1.82, 5.72)	4.32(2.67, 7.88)	0.000***
	36–47	5.56 (4.34–6.89)	6.99 (4.59–7.48)	0.000***
	48–59	1	1	1
Sex	Male	2.43 (0.77, 1.89)	1.69 (0.91, 1.34)	0.000**
	Female	1	1	1
Residence	Urban	0.87 (0.92–2.77)	1.86 (0.75–1.32)	0.001**
	Rural	1	1	1
Region	Tigre	1	1	1
	Afar	1.63 (0.97–1.98)	0.57 (0.59–1.70)	0.002*
	Amara	0.98 (0.64–1.42)	1.79 (1.45–1.70)	0.000**
	Oromo	1.52 (0.87–1.56)	0.95 (0.80–1.43)	0.001**
	Ethiopian-Somalia	2.42 (1.53–2.70)	3.54 (0.54–0.77)	0.000***
	Benishangul-Gumuz	1.98 (0.81–1.59)	1.45 (0.82–1.75)	0.001**
	SNNP		1.82 (1.04–0.86)	0.000***
	Gambela	0.53 (0.41–0.78)	3.04 (0.87–1.69)	0.000***
	Harari	0.89 (0.69–1.27)	1.79 (0.88–2.04)	0.002*
	Addis Ababa	0.52 (0.35–0.94)	0.86 (0.67–1.23)	0.001**
	Dire-Dawa	1.05 (2.67–1.89)	1.81 (1.05–1.85)	0.001**
Mother's education	Secondary education completed	1.09 (1.08–1.32)	0.94(1.08–1.31)	0.000***
	Primary education completed	1.10 (0.88–1.22)	0.94 (0.66–1.11)	0.001**
	No education	1.67 (0.79–0.94)	1.78 (0.97–1.63)	0.000***
	Above secondary	1	1	0.000***
Wealth quintile	Lowest	1.35 (1.86–1.77)	1.11 (0.88–1.45)	0.001***
	Second	1.77 (0.67–0.91)	1.93(0.82–1.96)	0.001**
	Middle	0.92 (0.78–0.92)	0.69 (0.70–0.87)	0.001***
	Fourth	0.97 (0.97–0.69)	0.98 (1.03–1.03)	0.000***
	Highest	1	1	1

Source: EDHS, 2019

4.1 Determinants of stunting (height-for-age)

This study discovered that children's age, sex, residence, geographical region, mother's education, and the wealth status of households were significant predictors for child stunting. These findings are similar to the surveys conducted in Uganda and Burkina Faso [16, 17]. This study discovered that age in months was a significant predictor of stunting issues in children under five. However, among the age groups, those whose ages were between the months of 36 and 40 were severely more vulnerable to child stunting than the other age groups. In the same vein, the findings of this study conformed to the study conducted by Tosheno et al. [18]. Comparatively, the results of this study have shown some decrements in stunting levels compared to the Ethiopian demographic health survey conducted in 2016. According to Kassie and Workie [10], children between 36 and 40 months are more than seven times as affected by stunting. However, this study discovered that children aged between the months of 36 and 40 were comparatively vulnerable to stunting six times more. This shows the issues have become relatively less common.

Child sex and place of residence were significant predictors of stunting. However, this study found that male children and rural residents faced severe stunting. These findings are strongly supported by [10, 11, 16]. These research findings

are unlikely to have some rate increments compared to the Ethiopian demographic survey, 2016, and the research conducted by Kassie and Workie [10]. According to Kassie and Workie [10], males were more than 0.8 times more affected by stunting than females. However, this study shows the level of stunting has slightly increased and is becoming more assertive in males at a rate of more than once. This one is hideous. Similar to Zeray et al. [11] and Kassie and Workie [10], this study discovered that lower maternal education and having a lower wealth (poorer) quintile have a higher risk of stunting in Ethiopia. The same with [12]. This study found that because educated moms understand child health and nutrition better, they are more concerned about their children's health and take better care of them. This study also found that the children from Amhara, Benishangul Gumuz, Gambella, Harari, and Dire-Dawa faced severe stunting more than once compared to the other remaining regions in Ethiopia. However, since the 2016 Seqota declaration was being piloted in only the Tigray and Amhara regions, it doesn't give enough concern to other geographical areas. Apart from the Amhara and Tigray regions, the problem of stunting has also affected other regions of Ethiopia. This study strongly recommends the need to provide equal attention to all other regions equally [14].

4.2 Determinants of wasting (weight-for-height)

Similar to data stunting, our data findings revealed that age in months, sex, domicile area, mother's education, and income position is essential predictors of wasting (weight for height). We discovered that children aged less than six months and between the months of 12–17 and 36–47 experienced a significant wasting condition more than three and five times, respectively. These findings have been similar to the results of Kassie and Workie [10]. Despite Tekile et al. [12], this study discovered that the problem of wasting was more severe in children between the ages of 0–17 and 36–47. However, Tekile et al. argued that the rate of wasting was more severe in children between the ages of 0 and 24. This study also revealed that, at a regional level, the wasting problem was more severe in Ethiopia, Somalia, and Gambella. The 2016 EDHS as being investigated by [10, 13] stated that the wasting problem was more prevalent in Tigray and Ethio-Somalia. However, this study discovered that the rate of the wasting problem was more severe in the Gambella and Ethiopian Somaliland regions. In the same vein, Amare et al. [19] noted that the Gambella, Afar, and Somalia areas of Ethiopia have a severe wasting problem. Although the government outlined the Seqota declaration and the Sustainable Development and Poverty Reduction Programme, the problem of wasting continued to be severe in the Gambella, Afar, and Somalia regions, particularly among the second 1000 days of children. Policymakers argue that this failure has happened because most of the residents in these regions are pastoralists, and this situation makes it very difficult for the government and other stakeholders to deliver adequate health facilities and nutrition equipment. The researchers here strongly recommend the need to provide infrastructural development programs and safety net service provisions not only to reduce the suitability of children under 1000 days but also children in the second 1000 days. Furthermore, these areas are plagued by persistent drought, which harms public health and the nutritional state of the people, particularly children. Also, those areas are less developed in terms of various infrastructural facilities, including health care services.

This study also revealed that children from the lowest wealth quintile were more prone to stunting than the other wealth groups. It indicated that households from the lowest quintile of wealth groups were unable to afford their children's welfare services and unable to get better social services for their children. Due to this, their children's vulnerability to waste has increased.

4.3 Determinants of underweight (weight-for-age)

This study affirmed that the problem of underweight children has become more severe in Ethiopia. The results of these study findings have shown that the issue of being underweight was more severe among children whose ages were between the months of 0–6, 24–35, and 36–47. These findings were consistent with the results of [10, 13]. There was also underweight severity based on children's sex and place of residence. This study revealed that male children who reside in rural areas were more seriously affected by being underweight than female and urban residents. It was consistent with the results of [2, 13]. Unlike the Ethiopian Demographic Health Survey in 2016 examined by [2, 10, 11, 13], this study discovered that the problem of stunting was more severe in children from Gambella and Ethiopian Somali regions. However, the previous Ethiopian demographic health survey in 2016 affirmed that the issue of being underweight was lower in Gambella and Addis Ababa. However, this study has shown a significant change in the underweight problem at the regional level. This study also discovered that the children from these poorer households and the first lowest households were affected and faced less than one time underweight than those from the middle and fourth wealth quintile status. In the same vein, Yirga et al. [13] assert that children from the poorest families have poor nutritional quality because we

cannot separate food security from nutritional status. Unlike children from high-income homes, if the children have an additional health concern, whether it is an acute sickness or a chronic problem, they will not be able to access prompt, quality health treatment because they cannot pay health care charges unless they are supported.

5 What this study added

Based on the Ethiopian mini-demographic health survey, 2019, this study aims to assess the factors of stunting, wasting, and underweight in children under the age of five in Ethiopia. According to the researchers, no thorough investigations have been undertaken in tandem with the EDHS 2019. However, utilizing multivariate analysis, this study aims to investigate the issue of stunting, wasting, and underweight. Furthermore, this study compared the prevalence rate of under-5-child nutrition using three anthropometric indicators (stunting, wasting, and underweight) to the Ethiopian demographic health survey (2016) to analyze the expected changes. Unlike other studies, this study attempted to provide concrete policy suggestions about addressing child nutrition and how health extension workers should identify children with severe acute malnutrition for treatment.

6 Study limitations

A cross-sectional study design was used for this study. As a result, the authors could not detect seasonal fluctuations in nutritional status and failed to establish a causal relationship. Several variables in the dataset have missing values. As a result, the authors miss certain crucial aspects that might impact the data's interpretation. Multi-factor treatments should be used to address the nutritional condition of children. By providing essential services, policy measures that reduce the impact of undernutrition may be implemented to increase access to health care. Further studies should look at the particular reasons that cause gender and region differences in the frequency of child malnutrition and analyze the spatial epidemiology of child malnutrition in Ethiopia to find hotspots of malnutrition.

7 Practical policy recommendations

The government of Ethiopia outlines the Sustainable Development and Poverty Reduction Programme (SDRPP) (Ethiopia's Poverty Reduction Strategy Paper—PRSP). This program incorporates elements of public health, food, and gender approaches to addressing malnutrition. Despite recognizing the problem and effects of malnutrition on child survival and development, the government has no concerted schemes and guidelines that have been designed and implemented at the national level that include children above the age of 24 or children of the second 1000 days. Although there is no clear nutrition policy and strategies in the country, it is included under SDRPP. As a result, it pays little attention to the differential impact of family livelihood patterns and caregivers' productive work responsibilities on child well-being, particularly above the age of 24. The authors recommend the federal government pay attention to children's well-being above 24 months, and it might be resolved through the Agricultural Development Led Industrialization (ADLI) strategy and related food security initiatives.

Policymakers and stakeholders in Ethiopia should prioritize the issue of child malnutrition by designing inter-sectorial policies and interventions. A variety of actions are needed from different stakeholders to address the problem of undernutrition. These actions include agricultural and micronutrient interventions and the provision of safe drinking water and sanitation, education about and support for better diets, special attention to vulnerable groups such as pregnant women and young children, and quality health services. Furthermore, these strategies and programs should place a greater emphasis on children in their second thousand days, like stunting, wasting, and being underweight are common among children over the age of 24 months or in their second thousand days.

Malnutrition isn't necessarily the first or only issue, and continued funding for HEP (Health Extension Practice) is essential. A transition toward more multi-purpose frontline health personnel with a high ratio of households, on the other hand, might offer up new prospects. However, according to a recent evaluation of community health workers' potential contributions, clearly defined responsibilities and a restricted set of specialized duties are likely to contribute to higher performance.

Of course, there are a variety of policies relating to child nutrition, but none of them has been able to provide the desired outcomes. However, according to the researchers, these regulations are lacking in enforcement, specific plans and programs, and a robust monitoring and evaluation system. As a result, we urge that the government take serious measures to enforce, monitor, and evaluate nutritional policies to address the problem of malnutrition among children aged 0–59.

The Ethiopian food and nutrition strategy must promote food and nutrition security and, in the long run, contribute to improved livelihoods, economic productivity, citizen longevity, and the nation's overall development and prosperity. The policy must establish food and nutrition priorities that the implementing sectors and other relevant stakeholders must take on with solid responsibility and accountability through effective multi-sectoral collaboration and integration. The Ethiopian food and nutrition policy (2018) should reinforce social protection programs for children to ensure fair and equitable distributions of diversified and fortified foods for children. Besides, this study's findings revealed that the wealth quintile of the households was another determinant of child malnutrition. However, this study recommends strengthening the income generation scheme, job creation training, and market linkage of food commodities to improve the households' livelihoods. As the livelihoods of families are enhanced, the children could get nutritious and fortified food, which can reduce the level of malnutrition.

7.1 Recommendations related to identifying children with severe acute malnutrition for treatment

The health extension workers in the Ethiopian Health Demographic Health Survey used a rapid assessment method without having a medical laboratory or checkups. So to label children, at least the health extension workers should examine some medical checkups related to wasting, stunting, and being underweight. Children who have been diagnosed with severe acute malnutrition should have a comprehensive clinical examination to see whether they have medical issues and whether they have an appetite. Children who have an appetite (pass the appetite test) and are clinically healthy and aware should be given outpatient treatment. Inpatient treatment is recommended for children with medical issues, significant edema (+++), low appetite (failure of the appetite test), or one or more IMCI warning signs.

The issues of stunting, wasting, and being underweight were identified in the Ethiopian Demographic Health survey through interviews with some selected mothers around the regions in Ethiopia. However, to indicate the problem, the health extension workers should use mid-upper arm circumference; otherwise, the data will be inaccurate. To identify children with severe acute malnutrition early in the community, qualified community health workers and members should measure the mid-upper arm circumference and look for bilateral pitting edema in newborns and children aged 6–59 months. Infants and toddlers aged 6–59 months who have a 115 mm mid-upper arm circumference or any degree of bilateral edema should be directed to a treatment facility for a thorough assessment and treatment of severe acute malnutrition.

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

Declarations

Ethics approval and consent to participate The researchers obtained an official approval letter from an Ethiopian public health institution before performing this study. After receiving approval from the IRB (internal review board), the manuscript was critically assessed and authorized by the Wolkite University research center and Department of Sociology for study adherence (Ref No: SOCI/805/2022).

Consent for publication This study's data relied on the Ethiopian Demographic Health Survey, 2019, and the data used in the study was obtained from EPHI (Ethiopian public health institution).

Competing interests The authors have no conflicts of interest to declare that are relevant to the content of this article.

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