


Diarrhea and associated factors among under-5 children in Ethiopia: A secondary data analysis

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Abstract

Objectives: Diarrhea is a major contributing factor for preventable childhood morbidity and death. Despite the occurrence of diarrhea is decreasing, its effect is increasing at an alarming rate among under-5 children particularly in developing countries. The survey was aimed to assess diarrhea and associated factors among children less than 5 years (0–59 months) in Ethiopia with nationally representative data.

Methods: The data were extracted from the Ethiopian National Survey of 2016. A logistic regression model was undertaken to identify the contributing factors for childhood diarrhea. Variables with $p < 0.05$ were considered as independent predictors of childhood diarrhea.

Results: From a total of 10,641 under-5 children, 5483(51.5%) were males and most of the children (62.3%) were above 24 months. About 10.2% had diarrhea 14 days before data collection, and the majority (93.1%) were born to married mothers. Receiving no treatment or advice for fever/cough (adjusted odd ratio (AOR) = 0.170, 95% confidence interval (CI): 0.139–0.208, $p = 0.001$), being permanent residence (AOR = 0.583, 95% CI: 0.347–0.982, $p = 0.043$), initiating breastfeeding after 24 h of birth (AOR = 1.553, 95% CI: 1.197–2.015, $p = 0.001$), and lack of prenatal care (AOR = 2.142, 95% CI: 0.624–0.875, $p = 0.001$) were independent predictors of diarrhea among under-5 children's in Ethiopia.

Conclusion: The result of this survey indicated that diarrhea is a significant health challenge among under-5 children. To tackle this illness, sufficient education on child and maternal health has to be provided for mothers focusing on predictive factors.

Keywords

Children, diarrhea, 0–59 months, Ethiopia

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Introduction

Globally diarrhea is a leading cause of preventable childhood illness and death.^{1–3} Although a previous study indicated that in Ethiopia the occurrence of diarrhea reduced from 2000 to 2016,⁴ the burden is highly dangerous for under-5 children by causing dehydration with significant death in infancy and childhood. The double effect of high cause-specific illness and the lack of effective intervention make diarrhea and its intervention a priority area for health services.⁵ Different factors like maternal-related, environmental-related, feeding-related, and child status can influence childhood diarrhea.⁶ In addition, monthly income, place of residence, and presence of children with less than 5 years in the household are some of the factors that are directly related to the occurrence of diarrhea in under-5 childhood.^{4–7}

In Ethiopia, only a few mothers and primary caregivers provide good diarrheal management after its occurrence, which exacerbates the condition and even leads to death of under-5 children.⁸ In another way, searching for treatment in

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eastern Africa including Ethiopia is lower when compared with south-eastern Asia.⁹ This low level of searching for diarrheal treatment is problematic in eastern Africa particularly in Ethiopia where treatment seeking has been somewhat limited.⁹

Children with diarrhea will face many problems like loss of appetite and inadequate nutrient uptake that has the potential to cause weight loss and growth failure. Diarrhea also causes water and electrolyte deficit when not replaced on time.¹⁰ A study from Tanzania revealed that around one-third of the mothers/caregivers have no awareness regarding the determining factors for diarrhea and 30% of them perceived it occurs as part of a healthy growth stage for the child.¹¹ In Ethiopia, the prevalence of poor diarrheal management practice (63%) is higher than other sub-Saharan African countries.⁸ The occurrence might be related to different factors like drinking water source that directly affects diarrhea in developing countries like Ethiopia.¹²

As diarrhea needs immediate management, it is better to identify the determinant factors for essential treatment and good outcomes. Since the diarrheal disease is a public health problem, it needs urgent and on time management to minimize its complications. Hence, this survey aimed to reveal disclose determinant variables for under-5 diarrheal prevalence in Ethiopia.

Methods

Study design and study period

The authors used secondary data extracted from the National Demographic and Health Survey of Ethiopia in 2016. Hence, retrospective cross-sectional study was conducted using already collected data.

Inclusion criteria

- All data of under-5 children and
- All data of mother or caregiver having under-5 children were included.

Sample size determination and sampling procedure

A data extraction form was developed from previous literatures. The Ethiopian National Demographic and Health Survey (EDHS) data were accessed at (<http://idhsdata.org>) as a reference point.¹³ All necessary data edits and cleaning were undertaken before final data analysis. Accordingly, this study utilized data related to 10,641 under-5 children extracted from the EDHS of 2016.

Data collection method

The data set was selected with consideration of environmental and socioeconomic determinants of childhood diarrhea

among under-5 children in order not to miss important variables.

Data analysis and interpretation

Extracted data were reviewed for fitness, coded, and analyzed using the Statistical Package for Social Sciences version 24.0. Bivariable and multiple variable logistic regression model were used to assess the association of determinant factors of childhood diarrhea. All variables found significant at p -value < 0.25 and 95% confidence interval (CI) in the bivariable analysis were computed into the model. Variables that were significant at p -value < 0.05 were considered determinant factors of childhood diarrhea. The findings were indicated in the form of statements and tables (Tables 1–4). The strength of the association of factors affecting the occurrence of diarrhea was assessed using the odds ratio at 95% CI.

Operational terms

- Permanent/ usual residence: The place at which a person normally spends the daily period of rest, regardless of temporary absences for purposes of recreation, holiday, visits to friends and relatives, business, medical treatment or religious pilgrimage or, in default, the place of legal or registered residence. The person living in usual residence is called “Permanent/ usual resident.”
- Visitors: Are temporary travelers for the purpose of recreation, holidays, visits to friends or relatives, business, medical treatment or religious pilgrimage without changing usual residence.

Sociodemographic and health characteristics

From the 10641 under-5 children, 5483 (51.5%) were males and 93.1% of children were born to married mothers. Most mothers were non-educated (64.3%) and 59.3% had no work during the survey. Nearly two-thirds of the children were above 24 months and 81.1% were from families with two or fewer children (Table 1).

Clinical illness of children

In the current study, anemia screen was conducted in 43.1% of children. Within this data set, 23.19% had moderate anemia, 17.38% had mild anemia, and 2.92% had severe anemia. About 14.9% had a cough or difficulty of breathing 2 weeks before the survey and 10.2% had recent diarrhea (Table 2).

Determinants of under-5 diarrhea

Binary regression was conducted to identify candidate variables for multivariate analysis to disclose determinant factors of under-5 diarrheal morbidity. Accordingly, variables

Table 1. Sociodemographic and health factors of less than 5 years (0–59 months): findings from the EDHS of 2016.

Socioeconomic and health characteristics		Frequency (n = 10641)	%
Woman's current marital or union status	Never married	61	0.6
	Married	9903	93.1
	Living together	105	1.0
	Widowed	135	1.3
	Divorced	328	3.0
	Separated/not living together	109	1.0
Household wealth index in quintiles	Poorest	3993	37.5
	Poorer	1782	16.7
	Middle	1466	13.8
	Richer	1308	12.3
	Richest	2092	19.7
Location of toilet facilities	Located within dwelling	173	1.6
	Outside dwelling, in plot/courtyard	4839	45.5
	Other locations	903	8.5
	NIU (not in universe)	4726	44.4
Highest educational level	No education	6838	64.3
	Primary	2678	25.2
	Secondary	734	6.9
	Higher	391	3.6
Maternal occupation status	Not working	6481	60.9
	Working	4160	39.1
Address	Urban	1974	18.6
	Rural	8667	81.4
Child's age in months	Less than 6 month	1300	12.2
	6–11 months	807	7.6
	12–23 months	1909	17.9
	24 and above	6625	62.3
Breastfeeding status (categorical)	Still breastfeeding	4252	40.0
	Ever breastfed, not currently breastfeeding	5814	54.6
	Never breastfed	575	5.4
Sex of child	Male	5483	51.5
	Female	5158	48.5
Child is alive	No	635	6.0
	Yes	10006	94.0
Number of children in household	≤2	8627	81.1
	≥3	2014	18.9
Type of resident	Usual/permanent resident	10508	98.8
	Visitor	133	1.2

NIU: not in the universe which means not applicable to them.

with p-value of less than 0.25 were entered together to manage the effect of confounding variables (Table 3).

Treatment seeking for fever or a cough, maternal prenatal care, duration of breastfeeding and permanent resident or visitor status at the time gap between feeding breast milk and birth were significantly associated with childhood diarrhea upon multivariate analysis.

Children receiving no treatment or advice for fever/cough were 83% times more likely to had diarrhea (adjusted odd ratio (AOR)=0.170, confidence interval (CI) 95%: 0.139–0.208) when compared with who received treatment or

advice for fever/cough. Being permanent residence (AOR=0.583, 95% CI: 0.347–0.982, p=0.043) was associated with lower diarrhea as compared with visitors. Children born to mothers who initiated breastfeeding after 24 h of birth were 1.5 times to manifest with diarrhea (AOR=1.553, 95% CI: 1.197–2.015) when compared with children born to mothers who practiced breastfeeding immediately after birth. Those children whose mothers did not receive prenatal care were two times to have diarrhea (AOR=2.142, 95% CI: 0.624–0.875) when compared with children receiving prenatal care (Table 4).

Table 2. Clinical illness of children data from demographic and health characteristics of under-5 (0–59) children: finding from EDHS of 2016.

Clinical illness of children		Frequency (n)	%
Child had cough/difficult breathing recently	No	8337	78.3
	Yes, last 2 weeks	1586	14.9
	Don't know	83	0.8
	NIU (not in universe)	635	6.0
Child taken to medical facility for fever/cough treatment	Did not receive any treatment	1182	11.1
	Received treatment	525	4.9
	System missing	8	0.1
	NIU	8926	83.9
Treatment or advice sought for child's fever/cough	No, received treatment	554	5.2
	Yes, no treatment or advice sought	999	9.4
	System missing	8	0.1
	NIU	9080	85.3
Treatment or advice sought for child's diarrhea	No, received treatment	545	5.1
	Yes, no treatment or advice sought	545	5.1
	NIU	9551	89.8
Child taken to medical facility for diarrhea treatment	No	569	5.3
	Yes, treatment at medical facility	521	4.9
	NIU	9551	89.8
Child breathed with short and rapid breaths when had cough	No	9028	84.8
	Yes	891	8.4
	Don't know	87	0.8
	NIU	635	6.0

NIU: not in universe which means not applicable for them.

System missing: during extraction variables if the data revealed missed data, those variables that are not important for this study, as well it is not needed or have no effect on outcome variable of this finding.

Discussion

In this study, 10.2% of children in the EDHS had experienced diarrheal disease within 2 weeks before the survey. The result was comparable with a systemic review for Africa, which revealed that 10.3% of under-5 children experienced diarrhea.¹⁴ However, the result obtained was lower than previous studies conducted in Ethiopia,^{5,7,15–23} Cameroon (23.8%),²⁴ Yemen (29.07%),²⁵ and Vietnam (11%).²⁶ The discrepancy in percentage may be attributed to environmental and infrastructure differences like sanitation services and water sources.^{15,22} Under-5 immunization coverage has increased from 24% to 39 in Ethiopia, which plays a pivotal role in diarrheal disease prevention and strengthen the immunity of under-5 children.¹³

According to the current study, children residing in urban settings had less when compared with those children living in rural residences. This finding was in line with studies done in northwest Ethiopia.^{5,15,16,20,27–29} However, it was in contrast with the result from Sudan which stated that urban children were more likely affected by diarrhea than in their rural counterparts.³⁰ The difference may be attributed to the variation in population distribution, urban characteristics and availability of infrastructures in different countries. In reality, urban residents have access to clean water which might not be possible in rural as most of the diarrheal cases arise from drinking water source.^{15,22,31}

In this present study, prevalence of diarrhea was higher in males than in females which was similar with the study from Nepal,³ Farta Wereda, Ethiopia,¹⁶ Woloyita Soddo,⁷ Bhutan,³² Northwest Ethiopia,²⁰ and West Africa.³³ However, the study result was in contrast with the study from Tanzania¹¹ and Arbamich.¹⁷ Children born to mothers who initiated breastfeeding milk after 24 h of birth were 1.5 times more likely to have diarrhea when compared with children born to mothers who practiced breastfeeding immediately after birth. The finding was comparable to the studies conducted in sub-Saharan African countries.^{23,34}

This study also indicated that children who did not seek treatment for fever or cough were unlikely to have diarrhea when compared with children who seek help. Children who exposed to fever or cough have decreased immunity due to repeated infection and the existence of different comorbidities including diarrhea.^{35,36} In another way, the advice or treatment given for fever or cough may not be used for a prevention strategy of under-5 diarrhea. The finding was also consistent with the study from India which stated children who received antibiotics for their first diarrhea episode had their second episode.³⁷

The result of the study revealed that those children born to mothers/caregivers that did not attend adequate prenatal care were more likely to experience diarrhea when compared with counterparts. This is because prenatal care

Table 3. Bivariable logistic regression on factors associated with childhood diarrheal diseases within under-5 (0–59) children in Ethiopia: finding from EDHS of 2016.

Variables		Presence occurrence of diarrheal diseases 2 weeks prior to the survey		Total	COR	CI	p-value
		No	Yes				
Child's age	<6 months	1189 (91.5%)	111 (8.5%)	1300 (100.0%)	1.190	(0.959–1.47)	0.114
	6–11 months	646 (80.0%)	161 (20.0%)	807 (100.0%)	3.176	(2.611–3.864)	<0.001*
	12–23 months	1573 (82.4%)	336 (17.6%)	1909 (100.0%)	2.722	(2.343–3.163)	<0.001*
	24 and above	6143 (92.7%)	482 (7.3%)	6625 (100.0%)	1		
Working status of mother	Not working	5699 (90.4%)	608 (9.6%)	6307 (100.0%)	0.848	(0.746–0.963)	0.011*
	Working	3695 (88.8%)	465 (11.2%)	4160 (100.0%)	1		
Educational status of the mother	No education	6174 (90.3%)	664 (9.7%)	6838 (100.0%)	0.827	(0.724–0.945)	0.005*
	Primary education and above	2930 (88.5%)	381 (11.5%)	3311 (100.0%)	1		
Treatment sought for fever /cough	No	9218 (91.4%)	869 (8.6%)	10087 (100.0%)	1		
	Yes	333 (60.1%)	221 (39.9%)	554 (100.0%)	0.142	(0.118–0.171)	<0.001*
Place of delivery	Home	6480 (90.6%)	675 (9.4%)	7155 (100.0%)	1		
	Public health facility	2971 (88.2%)	399 (11.8%)	3370 (100.0%)	1.289	(1.131–1.470)	<0.001*
	Other	100 (86.2%)	16 (13.8%)	116 (100.0%)	0.115	(0.901–2.619)	0.115
Prenatal care received	No	5495 (92.7%)	434 (7.3%)	5929 (100.0%)	0.488	(0.430–0.555)	<0.001*
	Yes	4056 (86.1%)	656 (13.9%)	4712 (100.0%)	1		
Time gap between breast feed and birth	Within first 1 h	4393 (87.7%)	618 (12.3%)	5011 (100.0%)	1		
	Within first 24 h	1170 (85.8%)	193 (14.2%)	1363 (100.0%)	1.173	(1.124–1.822)	0.073*
	After 24 h	447 (83.2%)	90 (16.8%)	537 (100.0%)	1.431	(1.124–1.822)	0.004*
	Don't know/missing/not in universe	3541 (94.9%)	189 (5.1%)	3730 (100.0%)	0.379	(0.320–0.449)	<0.001*
Breastfeeding category	Never fed breast milk	552 (96.0%)	23 (4.0%)	575 (100.0%)	1		
	Still feeding breast milk	3614 (85.0%)	638 (15.0%)	4252 (100.0%)	4.237	(2.769–6.484)	0.001*
	Ever fed breast milk, not currently feeding breast milk	5385 (92.6%)	429 (7.4%)	5814 (100.0%)	1.912	(1.246–2.935)	0.003*
Type of resident	Permanent/usual resident	9439 (89.8%)	1069 (10.2%)	10508 (100.0%)	0.604	(0.37–0.96)	0.036*
	Visitor	112 (84.2%)	21 (15.8%)	133 (100.0%)	1		
Number of children in household	≤2	7704 (89.3%)	923 (10.7%)	8627 (100.0%)	1.325	(1.115–1.574)	0.001*
	≥3	1847 (91.7%)	167 (8.3%)	2014 (100.0%)	1		

CI: confidence interval; COR: crudes odds ratio.

*Significant at $p < 0.25$.

includes all the care given for the child and mother for prevention of diarrhea

Limitation of the study

The study was associated with some limitations. First, this study was related to the use of retrospective secondary data, which have some issues with missing and getting inaccurate data. Second, the data were collected as per the EDHS, which can result in the loss of some of the important maternal and child relevant variables. Third, variables like dehydration, distance from the drinking water source, home-based water treatment, maternal or caregiver's diarrheal history and handwashing practice were important variables for the outcome variable. Since these variables were not collected during the time of data collection, it results in lack of information to determine the cause and effect of these variables in this

analysis. Finally, we did not calculate the sample size because we have used already collected data.

Conclusion

The result of this research indicated that there is considerable proportion of under-5 diarrhea in Ethiopia. Obtaining treatment for fever or a cough, starting breastfeeding milk after 24 h of birth, obtaining prenatal care, and being permanent resident were the determinant factors for the occurrence of diarrhea. To tackle diarrhea, appropriate incidence of education on child and maternal health has to be given for mothers by giving special attention to above-stated determinant factors. Finally, we recommend other researchers to conduct large sample size patient-based quantitative and qualitative studies for further exploration of different causes of diarrhea among under-5 children.

Table 4. Multivariable analysis result of factors associated with less than 5-year children diarrheal disease among under-5 (0–59 months): finding from EDHS of 2016.

Variables		Presence occurrence of diarrheal disease 2 weeks prior to the survey		Total	COR	AOR	CI	p-value
		No	Yes					
Treatment/advice sought for fever/cough	No	9218 (91.4%)	869 (8.6%)	10087 (100.0%)	0.142	0.170	(0.139–0.208)	<0.001*
	Yes	333 (60.1%)	221 (39.9%)	554 (100.0%)	1			
Prenatal care received	No	5495 (92.7%)	434 (7.3%)	5929 (100.0%)	2.049	2.142	(0.624–0.875)	<0.001*
	Yes	4056 (86.1%)	656 (13.9%)	4712 (100.0%)	1			
Time gap between feed breast milk and birth	Within first 1 h	4393 (87.7%)	618 (12.3%)	5011 (100.0%)	1			
	Within first 24 h	1170 (85.8%)	193 (14.2%)	1363 (100.0%)	1.173	1.076	(0.891–1.300)	0.447
	After 24 h	447 (83.2%)	90 (16.8%)	537 (100.0%)	1.431	1.553	(1.197–2.015)	0.001*
	Don't know/missing	3541 (94.9%)	189 (5.1%)	3730 (100.0%)	0.379	0.714	(0.555–0.919)	0.009*
Residence	Urban	1788 (90.6%)	186 (9.4%)	1974 (100.0%)	0.893	0.659	(0.535–0.812)	<0.001*
	Rural	7763 (89.6%)	904 (10.4%)	8667 (100.0%)	1			
Type of resident	Permanent/usual resident	9439 (89.8%)	1069 (10.2%)	10508 (100.0%)	0.604	0.583	(0.347–0.982)	0.043*
	Visitor	112 (84.2%)	21 (15.8%)	133 (100.0%)	1			

COR: crude odds ratio; CI: confidence interval; AOR: adjusted odd ratio.

*Statistically significant at $p < 0.05$.

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Author contributions

Conceptualization: G.F. (Getahun Fetensa); methodology: G.F., F.T., and G.F.* (Ginenu Fekadu); validation: G.F., F.T., J.M., and F.T.; formal analysis: G.F. and W.E.; data curation: G.F., F.T., J.M., W.E., G.F.*, and T.H.; manuscript draft preparation: G.F.* and G.F.; review and editing of manuscript: G.F., G.F.*, J.M., W.E., G.F.*, and T.H. All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

Data availability

This research used national survey data that are publicly available for research collected by the Central Statistical Agency [Ethiopia] and ICF. National Demographic and Health Survey of Ethiopia in 2016 [Data set]. Accessed (<http://idhsdata.org>).

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

The 2016 EDHS data are available to the general public by request in different formats from the Measure DHS website [<http://idhsdata.org>]. We applied the measure DHS by briefly stating the objectives of the study and got the permission to download the children's data set in SPSS format.

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Informed consent

Informed consent was not sought for the present study because we have used the already collected from online after permission was obtained from Ethiopian Central Statistical Agency of Ethiopia.

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References

1. UNICEF. *Pneumonia and diarrhea tackling the deadliest diseases for the world's poorest children*. New York: UNICEF, 2012, pp. 1–86.
2. World Health Organization. *Infant and young child feeding model chapter for textbooks for medical students and allied health professionals*. Geneva: World Health Organization, 2009.
3. Ministry of Health and Population and ICF International. Nepal, 2011, <https://dhsprogram.com/publications/publication-fr257-dhs-final-reports.cfm>
4. Woldeamanuel BT. Trends and factors associated with healthcare utilization for childhood diarrhea and fever in Ethiopia: further analysis of the Demographic and Health Surveys from 2000 to 2016. *J Environ Public Health* 2020; 2020: 8076259.
5. Central Statistical Agency and ICF International. Ethiopia Demographic and Health Survey, 2012, <https://dhsprogram.com/publications/publication-fr255-dhs-final-reports.cfm>
6. Asfaha KF, Tesfamichael FA, Fisseha GK, et al. Determinants of childhood diarrhea in Medebay Zana District, Northwest

- Tigray, Ethiopia: a community based unmatched case-control study. *BMC Pediatr* 2018; 18(1): 120.
7. Alambo KA. The prevalence of diarrheal disease in under five children and associated risk factors in Wolitta Soddo Town, Southern, Ethiopia. *ABC Res Alert* 2015; 3(2): 12–22.
 8. Carvajal-Vélez L, Amouzou A, Perin J, et al. Diarrhea management in children under five in sub-Saharan Africa: does the source of care matter? A countdown analysis. *BMC Public Health* 2016; 16(1): 830.
 9. Bennett A, Eisele T, Keating J, et al. *Global trends in care seeking and access to diagnosis and treatment of childhood illnesses*. Rockville, MD: ICF International, 2015.
 10. World Health Organization. *Hospital care for children*. Geneva: World Health Organization, 2005, pp. 109–120.
 11. Mwambete KD and Joseph R. Knowledge and perception of mothers and caregivers on childhood diarrhoea and its management in Temeke municipality, Tanzania. *Tanzan J Health Res* 2010; 12(1): 47–54.
 12. Alberini A, Eskeland G, Krupnick A, et al. *Determinants of diarrheal disease in Jakarta*. Washington, DC: The World Bank, 1999.
 13. Central Statistical Agency. *Ethiopian Demographic and Health Survey*. Addis Ababa, Ethiopia: Central Statistical Agency, 2016.
 14. Awotiwon OF, Pillay-van Wyk V, Dhansay A, et al. Diarrhoea in children under five years of age in South Africa (1997–2014). *Trop Med Int Health* 2016; 21(9): 1060–1070.
 15. Alebel A, Tesema C, Temesgen B, et al. Prevalence and determinants of diarrhea among under-five children in Ethiopia: a systematic review and meta-analysis. *PLoS ONE* 2018; 13(6): e0199684.
 16. Gedamu G. Magnitude and associated factors of diarrhea among under-five children in Farta Wereda. *Insight Med Publ Gr* 2017; 25(4): 199–207.
 17. Mohammed S, Tilahun M and Tamiru D. Morbidity and associated factors of diarrheal diseases among under-five children in Arba-Minch district 2013; 1(2): 102–106.
 18. Bizuneh H, Getnet F, Meressa B, et al. Factors associated with diarrheal morbidity among under-five children in Jigjiga Town, Somali Regional State, Eastern Ethiopia: a cross-sectional study. *BMC Pediatr* 2017; 17(182): 1–7.
 19. Hashi A, Kumie A and Gasana J. Prevalence of diarrhoea and associated factors among under-five children in Jigjiga District, Somali Region, Eastern Ethiopia. *Open J Prev Med* 2016; 6(10): 233–246.
 20. Anteneh ZA, Andargie K and Tarekegn M. Prevalence and determinants of acute diarrhea among children younger than five years old in Jabithennan District, Northwest Ethiopia, 2014. *BMC Public Health* 2017; 17(1): 99.
 21. Kasee LF, Merrom OS and Hassa HY. Assessment of the prevalence of diarrheal disease under-five children Serbo Town, Jimma Zone South West Ethiopia. *Clin Mother Child Heal* 2018; 15(1): 1–6.
 22. Girma R. Environmental determinants of diarrhea among under-five children in Nekemte Town, Western Ethiopia. *Ethiop J Health Sci* 2008; 18(2): 39–45.
 23. Gizaw Z, Woldu W and Bitew BD. Child feeding practices and diarrheal disease among children less than two years of age of the nomadic people in Hadaleala District, Afar Region, Northeast Ethiopia. *Int Breastfeed J* 2017; 12: 24.
 24. Tambe AB, Nzefa LD and Nicoline NA. Childhood diarrhea determinants in sub-Saharan Africa: a cross-sectional study of Tiko-Cameroon. *Challenges* 2016; 6: 229–243.
 25. Aidah M, Mohanna B, Sonboli N, et al. Prevalence of diarrhoea and related risk factors among children aged under 5 years in Sana'a, Yemen 2018; 11(1): 29–33.
 26. Action GH. Determinants of early childhood morbidity and proper treatment responses in Vietnam: results from the Multiple Indicator Cluster Surveys, 2000–2011. *Glob Health Action* 2016; 9: 29304.
 27. Region A, Mamo A and Hailu A. Assessment of prevalence and related factors of diarrheal diseases among under-five year's children in Debrebirehan Referral Hospital, Debrebirehan Town, North Shoa. *Open Access Libr J* 2014; 1(1): 1–14.
 28. Brhanu H, Negese D and Gebrehiwot M. Determinants of acute diarrheal disease among under-five children in Pawi Hospital, Northwest Ethiopia, 2013/14. *Am J Pediatr* 2017; 3(6): 68–75.
 29. Hamangaba H. Factors associated with diarrhea among under-five children in Zambia, 2016, <http://dspace.unza.zm/handle/123456789/4799>
 30. Siziya S, Muula AS and Rudatsikira E. Correlates of diarrhoea among children below the age of 5 years in Sudan. *Afr Health Sci* 2013; 13(2): 376–383.
 31. Bogale GG, Gelaye KA, Degefie DT, et al. Spatial patterns of childhood diarrhea in Ethiopia: data from Ethiopian Demographic and Health Surveys (2000, 2005, and 2011). *BMC Infect Dis* 2017; 17(1): 426.
 32. Wangdi K and Clements ACA. Spatial and temporal patterns of diarrhoea in Bhutan 2003–2013. *BMC Infect Dis* 2017; 17: 507.
 33. O NS and Kitaw D. Breastfeeding initiation time and its impact on diarrheal disease and pneumonia in West Africa. *J Public Heal Epidemiol* 2015; 7(12): 352–359.
 34. Ogbo FA, Agho K, Ogeleka P, et al. Infant feeding practices and diarrhoea in sub-Saharan African countries with high diarrhoea mortality. *PLoS ONE* 2017; 12(2): e0171792.
 35. Kuehn J, Ismael Z, Long PF, et al. Review article reported rates of diarrhea following oral penicillin therapy in. *J Pediatr Pharmacol Ther* 2015; 20(2): 90–104.
 36. Pediatric F, Section G, Pediatric I, et al. Antibiotic-associated diarrhea in children. *INDIAN Pediatr* 2009; 46: 491–496.
 37. Rogawski ET, Westreich DJ, Becker-Dreps S, et al. Antibiotic treatment of diarrhoea is associated with decreased time to the next diarrhoea episode among young children in Vellore, India. *Int J Epidemiol* 2015; 44(3): 978–987.