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Research Article

Diarrhea among Under-Five Years of Age in Laelay-Maychew District, Ethiopia: A Cross-Sectional Study

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Received: July 31, 2019; **Published:** August 29, 2019

Abstract

Background: Diarrheal disease is the leading cause of preventable death among children under five years of age in developing countries. In Ethiopia, it is the second leading cause of death among children under-five years of age. So that the aim of this study was to determine the status and associated factors of diarrhea among children under five years of age.

Method: A community based cross-sectional study was conducted from February 01- February 30, 2015. A total of 543 households having a child under five years of age was selected using systematic random sampling method. Data were entered into a computer using Epi Info version 7 software and exported to SPSS version 21 statistical software for further analysis. Binary Logistic regression analysis was used to determine the OR and 95% CI. Variables with p-value < 0.05 in the final model were considered as statistical significant.

Result: 17.7% of children under five years of age have diarrhea preceding two weeks before the data collection period. Rural residence [AOR: 1.52, 95% CI (1.26, 4.87)], mothers primary education level [AOR: 0.16, 95% CI (0.06, 0.41)], mothers ≥ secondary education level [AOR: 0.02, 95% CI (0.01, 0.12)], improved water source [AOR: 0.18, 95% CI (0.02, 0.39)], ≤ 20 liter water per capita consumption [AOR: 1.53, 95% CI (1.12, 1.97)], and mothers hand washing using water and soap [AOR: 0.52, 95% CI (0.24,0.80)] were significantly associated with under five diarrhea.

Conclusions: The two weeks period prevalence of under-five diarrhea was relatively high and residence, educational status of the mothers, water source of the households, per capita consumption of the households, and hand washing methods of the mothers were statistical significant predictors.

Keywords: *Diarrhea; Laelay-Maychew District; Under Five Years of Age; Ethiopia*

Abbreviations

AOR: Adjusted Odds Ratio; AIDS: Acquired Immune Deficiency Syndrome; CI: Confidence Interval; COR: Crude Odds Ratio; EDHS: Ethiopian Demographic and Health Survey; EPI INFO: Epidemiological Information; OR: Odds Ratio; PCA: Principal Component Analysis; SPSS: Statistical Package for Social Science; WHO: World Health Organization

Introduction

Globally, diarrheal disease is one of the foremost problems heartwarming children, sinking their health and creating high demand for health services. It is the primary cause of preventable deaths among under five years of age residing in low-income countries [1]. It causes death by depleting body fluids which result in a profound dehydration and may have a unfavorable impact on childhood growth and

cognitive development [2]. About 88% of diarrhea related deaths are explained by unsafe water, inadequate sanitation, and insufficient hygiene [3,4].

Diarrhea kills 2195 children every day more than AIDS, malaria and measles combined. It is responsible for 1 in 9 child deaths worldwide that makes diarrhea the second leading cause of death among children under five years of age [5].

A systematic review done in low income countries shows that diarrheal disease is responsible for 19% of total under-five deaths and Africa and South East Asia regions accounts for 78% of all diarrheal deaths occurring among under-five children [6]. In Africa diarrhea is responsible for 25 - 75% of all childhood diseases and accounts for about 14% of outpatient visits and 16% of hospital admissions [7].

Sub-Saharan Africa is still with the highest rates of child mortality where 1 in 9 children dies before age five that is more than 16 times the average for developed regions (1 in 152) and Southern Asia (1 in 16). Under-five mortality are highly concentrated in Sub-Saharan Africa and Southern Asia regions, while in the rest of the world dropped from 31 percent in 1990 to 17 percent in 2011. About 11% of under five mortality was attributed to diarrhea in Sub-Saharan Africa regions [8].

In Ethiopia, diarrhea account for 29.5% of infant mortality and 8.8% of under five years of age mortality [9]. According to the Ethiopian Demographic Health Survey 2011 report, 13% of Ethiopian under five children had diarrhea in two weeks preceding the survey [10]. Based on the 2010 Ministry of Finance and Economic Development report (MOFED), 20% of the childhood deaths in Ethiopia were due to diarrheal disease [11]. It is the second cause of under-five death second to pneumonia and it is the disease that can be easily prevented by improving health promotion and education [10].

There are limited information on the prevalence and socio-economic, behavioral and environmental factors of diarrhea among children under five years of age that were conducted so far. It was a community based study based on a preliminary survey conducted to identify eligible households/children which was used as a sampling frame. It was exhaustive study that was tried to assess environmental, behavioral, feeding habit and socio-economic and demographic variables which were explained as factors that can increase or decrease under five diarrheal morbidity.

Identifying socio-economic, demographic, environmental and behavioral factors associated with under five diarrhea is very crucial for effective early implementation of child health intervention programs, for policy formulation and general assessment of resource requirements and intervention prioritization. So that this study was aimed on assessement of prevalence and associated factors of under five diarrhea in Laelay-Maychew District, Tigray Region, Ethiopia.

Methods

A community based analytical cross-sectional study design was conducted in Laelay-Maychew district and data were collected from February 01 to February 30, 2015. Laelay-Maychew is one of the districts found in Central Zone of Tigray region, Northern Ethiopia. It is approximately 1,024 kilometers from Addis Ababa and 250 kilometers from Mekelle, the capital city of Tigray region. The district is divided into fifteen rural and one urban kebeles (the smallest administrative unit in Ethiopia), having a total population of 89,052 residents with a 50.15% female population. The total households of the district were 16,218 and 13.13% of the population were children under five years of age. Health services in the district were provided by four health centers and thirteen health posts. At the kebele level, health care is delivered by health extension workers who were assigned to render health services at the local level.

All households with mothers/care takers who have under five years of age child in the district and all selected households with at least one under five-child in the selected kebeles were the source and study populations respectively.

Households having child under-five years of age and families who had permanent residence in the area for at least six months were included in the study. Children who were chronically ill and with persistent diarrhea for greater than two weeks, critically ill or suffering mothers/care givers of the index child were excluded from the study.

A total of 543 sample size was taken using EPI INFO for window version 7 considering single population proportion formula (31% prevalence of diarrhea among under five years of age children taken from a study done in Arba-Minch district [12], 95% confidence level, 5% desired precision, 1.5 design effect and adding 10% for none response rate).

A two stage stratified sampling method was employed to select households which have at least one under five child. In the first stage, the one urban kebele was taken purposively and four rural kebeles were selected using simple random sampling method after stratifying the existing kebeles by residence. In the second stage, households having a child under five years of age were registered in each selected kebeles (preliminary survey was done to identify eligible households) and samples of eligible households were selected using systematic random sampling technique proportionally allocated to each kebeles. Households with at least one under five child were eligible for the study. In households with two or more under five children, one child was selected at random to collect a data on the child's demographic and health characteristics.

Data were collected using standard questionnaire and observational checklist using interviewer administration. The questionnaire was prepared based on Ethiopian Demographic and Health Survey. The questionnaire was prepared in English, translated into Tigrigna (local language) and then translated back into English to assure its accuracy. The respondents were primarily mothers of eligible under five years of age child, but in the absence of the mother, the next primary caregiver was interviewed.

Five data collectors who were clinical nurses and Tigrigna speakers were trained in questionnaire administration and data collection procedures. Pretest was done in 5% the respondents in another Kebele of the same study area. The result of the pretest was used to correct some unclear ideas and statements. Data collection was supervised by two health officer supervisors and the principal investigator at the center. Their role was to daily check the consistency, clarity and completeness of the collected questionnaires. The data collectors along with their supervisors took two days training about the questionnaire and data collection procedures.

The data were entered in to a computer using Epi Info 7 software and exported to SPSS V.21 statistical software for cleaning and further analysis of the data. Descriptive statistics was done to describe the study populations using measures of frequency and disease occurrence. Binary logistic regression analysis was used to determine the OR and 95% CI. The necessary assumption of logistic regression was checked using Hosmer and Lemeshow goodness-of-fit-test statistics. To reduce excessive number of variables and instability of the model, only variables with P-value < 0.2 in the bivariate analysis were considered for multivariate analysis. Variables with P-value < 0.05 in the multivariate analysis were considered as significant.

The following variables were used in this research and are defined as follows:

- **Diarrhea:** Diarrhea is defined as having three or more loose or watery stools per twenty four hours in two weeks period preceding the data collection, as reported by the mother/care taker of the child and prevalence is expressed as the number of diarrhea cases at the time of the interview divided by the total number of households included in the study.
- **Improved water source:** Improved water source is to mean that the water source used for drinking by the household members from bottled water, tape water, covered spring water, treated water or combination of any of them.
- **Economic status:** Economic status of households was categorized in to: lowest, second, middle, fourth and highest using wealth index calculated from the household's assets using principal component analysis (PCA)
- **Proper refuse disposal:** If the refuses where burned, buried in pit otherwise considered as improper.
- **Improved latrine:** Pour flush to piped sewer system/septic tank/pit latrine, VIP and pit latrine with slab otherwise considered as unimproved
- **Per capita water consumption:** Was calculated by considering frequency of water collection in a day, capacity of the container and family size.

$$\frac{\text{frequency of water collection per day (Liter)X capacity of container (Liter)}}{\text{Family size}}$$

Result

Demographic and socio-economic characteristics of the respondents

A total of 543 households were included in the study. The majority of the respondents 248 (45.7%) were 35 or more years of age, 280 (51.6%) of them were don't have formal education and 403 (74.2%) were farmers (Table 1).

Variable		Number (n = 543)	Percentage
Number of under five children	1	423	77.9
	2	120	22.1
Household family size	≤ 5	258	47.5
	> 5	285	52.5
Mothers education	No formal education	280	51.6
	Primary education	187	34.4
	≥ Secondary education	76	14.0
Occupation of mother	Farmer	403	74.2
	Housewife	103	19.0
	Other	37	6.8
Age of mother in years	18 - 24	72	13.3
	25 - 34	223	41.1
	≥ 35	248	45.7
Education of father	No formal education	220	40.5
	Primary education	212	39.1
	≥ Secondary education	111	20.4
Marital status	Married	504	92.8
	Divorced	28	5.2
	Other	11	2.0
Residence	Urban	71	13.1
	Rural	472	86.9
Wealth index	Lowest	108	19.9
	Second	97	17.9
	Middle	120	22.1
	Fourth	107	19.7
	Highest	111	20.4

Table 1: *Demographic and socio-economic characteristics of the households in Laelay-Maychew district, Tigray region, Ethiopia, 2015.*

Environmental characteristics of the households

Three hundred sixteen (58.2%) and 70 (12.9%) of the households had latrine and hand washing facility respectively. 415 (76.4%) and 330 (60.8%) of the households had proper waste disposal system and improved water source respectively (Table 2).

Variable name		Frequency (n = 543)	Percentage (%)
Latrine availability	Yes	316	58.2
	No	227	41.8
Type of latrine (n = 316)	Improved	121	38.3
	Not improved	195	61.7
Latrine ownership (n = 316)	Private	300	94.9
	Shared	16	5.1
Observed hand washing facility	Yes	70	12.9
	No	473	87.1
Refuse disposal method	Proper	415	76.4
	Improper	128	23.6
Water source	Improved	330	60.8
	Not improved	213	39.2
Daily per capita water consumption per day	≤ 20 liters	426	78.5
	> 20 liters	117	21.5
Time to water source	≤ 30 minutes	379	69.8
	> 30 minutes	164	30.2
Home based water treatment	Yes	165	30.4
	No	378	69.6

Table 2: *Environmental characteristics of the households in Laelay-Maychew district, Tigray region, Ethiopia, 2015.*

Feeding practice of the respondents

Most of the respondents 259 (56.4%) were preparing gruel (acereal based semisolid food like a porridge) for their children and 283 (61.7%) of the respondents feed their children using cup and spoon. 385 (70.9%) of the respondents often wash their hand using soap and water (Table 3).

Variable type		Frequency (n = 543)	Percentage (%)
The child take other food than breast feed	Yes	459	84.3
	No	85	15.7
Type of food the child take mostly n = 459	Cow's milk	46	10
	Gruel	259	56.4
	Adult food	121	26.4
	Other	33	7.2
Child feed method n = 459	Hand	176	38.3
	Cup and spoon	283	61.7
Reported hand washing method	Water and soap	385	70.9
	Water only	158	29.1

Table 3: *Behavioral characteristics of the respondents in Laelay-Maychew district, Tigray region, Ethiopia, 2015.*

Demographic and health characteristics of the indexed children

Three hundred four (56%) of the children were females with 195 (35.9%) of them in the age group of 36-59 months. In this study, 96 [17.7%, 95% CI (14.5 - 20.8) of the children had experienced diarrhea in the two week period preceding the study (Table 4).

Variable name		Number (n = 543)	Percentage (%)
Sex	Male	239	44
	Female	304	56
Age (in months)	≤ 11	107	19.7
	12 - 23	140	25.8
	24 - 35	101	18.6
	> 35	195	35.9
Current breast feeding status (n = 533)	Exclusive breast feeding	80	14.7
	Partial breast feeding	210	38.7
	Not on breast feeding	253	46.6
	< 6 months	19	4.1
Age at supplementary feeding	At 6 months	294	63.1
	> 6 months	153	32.8
	< 24 months	287	53.2
Duration of breast feeding	≥ 24 months	252	46.8
Measles virus vaccine	Yes No	469 20	95.9 4.1
Diarrhea	Yes	96	17.7,95%CI (14.5,20.8)
	No	447	82.3

Table 4: *Demographic and health characteristics of the indexed children in Laelay-Maychew district, Tigray region, Ethiopia, 2015.*

Determinants of diarrhea among children under five years of age

In the bivariate analysis; educational status of the mothers', age of the mothers', residence, water source of the households, daily per capita water consumption, hand washing method of mothers, sex of child, and age of child were significantly associated with under-five diarrhea. The multivariate analysis identified that residence, mothers' educational status, water source, per capita water consumption, and mothers' hand washing method were significant predictors of under-five diarrhea.

The probability of having diarrhea in under five children who lived in households of rural community were 1.5 times higher than those who lived in households of urban community [AOR: 1.52, 95% CI (1.26,4.87)]. Children of mothers with primary education level were 84% less likely to develop diarrhea compared to children of mothers who were with no formal education [AOR: 0.16, 95% CI (0.06, 0.41)]. Similarly, children of mothers who secondary and above education level were 98% less likely to have diarrhea compared to children of mothers with no formal education [AOR: 0.02, 95% CI (0.01, 0.12)].

Diarrhea was 82% less likely in children of households who had improved water source than in households of unimproved water source [AOR: 0.18, 95% CI (0.02, 0.39)]. Likewise, children from households who use ≤ 20 liter daily per capita water consumption were 1.5 times more probable to have diarrhea than those children from households who use > 20 liter per capita water consumption [AOR: 1.53, 95% CI (1.12,1.97)].

Children of mothers/care takers who wash their hand with water and soap were 48% less likely to develop diarrhea compared to children whose mothers/care takers wash their hand with water only [AOR: 0.52, 95% CI (0.24, 0.42)] (Table 5).

Explanatory Variables	Category	Diarrhea		COR 95%CI	AOR 95% CI
		Yes n (%)	No n (%)		
Residence	Urban	3 (4.2)	68 (95.8)	Ref	Ref
	Rural	93 (19.7)	369 (80.3)	5.56 (1.71,18.07)	1.52 (1.26,487)*
Sex of child	Male	31 (13)	208 (87)	Ref	Ref
	Female	65 (21.4)	239 (78.6)	1.82 (1.14,2.91)	3.85 (0.8-8.22)
Age of child (month)	< 11	21 (19.6)	86 (80.4)	Ref	Ref
	12 - 23	42 (30)	98 (70)	1.75 (0.96,3.19)	1.85 (0.60, 5.65)
	24 - 35	12 (11.9)	89 (88.1)	0.55 (0.26,1.19)	0.16 (0.02, 1.09)
	35+	21 (10.8)	174 (99.2)	0.49 (0.26,0.95)	0.12 (0.02, 1.89)
Mothrs education	No formal education	67 (23.9)	213 (76.1)	Ref	Ref
	Primary education	26 (13.9)	161 (86.1)	0.51 (0.31,0.84)	0.16 (0.06,0.41)*
	Secondary and higher education	3 (3.9)	73 (96.1)	0.13 (0.04,0.43)	0.02 (0.01,0.12)*
Mothers/care takers age	18 - 24	25 (34.7)	47 (65.3)	2.34 (1.31,4.18)	1.97 (0.68,5.70)
	25 - 35	25 (11.2)	47 (88.8)	0.55 (0.33,0.94)	0.22 (0.08,1.64)
	35+	46 (18.5)	202 (81.5)	Ref	Ref
Wealth index	Lowest	26 (24.1)	82 (75.9)	1.28 (0.67,2.44)	4.03 (0.31,12.43)
	Second	14 (14.4)	83 (85.6)	0.68 (0.33,1.42)	0.42 (0.14,1.27)
	Middle	22 (18.3)	98 (81.7)	0.91 (0.47,1.75)	0.68 (0.25,1.85)
	Fourth	12 (11.2)	95 (88.8)	0.51 (0.24,1.09)	0.60 (0.20,1.78)
	Highest	22 (19.8)	89 (80.2)	Ref	Ref
Water sources	Improved	67 (14.6)	393 (85.4)	0.32 (0.19,0.53)	0.18 (0.02,0.39)*
	Unimproved	19 (34.9)	54 (65.1)	Ref	Ref
Water consumption (liter)	≤ 20	86 (20.2)	340 (79.8)	2.71 (1.36,5.4)	1.53 (1.12,1.97)*
	> 20	10 (8.5)	107 (91.5)	Ref	Ref
Hand wash method	Water and soap	59 (15.3)	326 (84.7)	0.59 (0.37,0.94)	0.52 (0.20,0.80)*
	Water only	37 (23.4)	121 (82.6)	Ref	Ref

Table 5: *Determinants of under-five diarrhea in Laelay-Maychew district, Tigray region, Ethiopia, 2015.*
**=Significant at P-value < 0.05.*

Discussion

The finding of this study revealed that the two weeks period prevalence of diarrhea among under-five years of age children was 17.7%. Maternal education, residence, sex of child, households water source, per capita per day water consumption, and mothers/care takers hand washing method were significantly associated with under five diarhhea after adjusting other covariates.

The prevalence of under-five diarrhea in this study is similar with a study conducted in Egypt (19.5%) [13], Ghana (19.2%) [14] and west Gojam Zone of Ethiopia (18%) [15]. But this is relatively high compared EDHS 2011 report (13%) [10], to a study done in east Gojam Zone of Ethiopia 6.5% [16] and relatively low compared to a study done in Arba-Minch district of Ethiopia (30.5%) [12], Benishngul-

Gumuz of Ethiopia (22.1%) [17] and Kersa district of Ethiopia (22.5%) [18]. This difference could be due to the population difference in which in east Gojam zone the study was conducted purposively in a woreda with 90% latrine coverage. And this discrepancy in magnitude with the study done in Arba-Minch rural community could be their difference in socio demographic, basic environmental and behavioral characteristics of the population.

The finding on maternal education proposed that mothers with higher education experienced better chance of a child being spared of diarrhea compared to lower education mothers which is consistent with a cross-sectional study done in Iraq [19], Ghana [14], Benishangul-Gumuz of Ethiopia [17], west Gojam zone of Ethiopia [15] and south west Ethiopian rural community [20]. This is probably due to education provides important information about personal and environmental hygiene, weaning and feeding practices, and disease symptoms which boosts timely action on childhood illness.

Children from rural community were more probable to have diarrhea compared to children from the urban community. This is in contrast with the study done in Iraq [19] but in line with the studies conducted in Pakistan [21], Debrebirehan referral hospital in Ethiopia [22] and eastern Ethiopia [18]. This could be due to the urban community may have an access to improved water source, sanitation facility, health care facility and better Knowledge about the prevention and control of diarrheal disease.

Children from households who use improved water source were less vulnerable to experience diarrhea compared to children from households who use unimproved water source which is consistent with EDHS 2011 report [10], cross-sectional study done in west Gojam Zone in Ethiopia [15] and a case control study done in Derashe district of South Ethiopia [23]. This can be explained by unimproved water source tends to be more contaminated by pathogenic microorganisms and provides better breeding site than improved water source and thus decrease under-five diarrhea.

Children from households who use ≤ 20 liters of water per capita per day were more probable to develop diarrhea compared to children from households who use > 20 liters of water per capita per day. This finding is in contrast with a study from Nekemte town, Central Ethiopia [24] but in agreement with studies from south western Ethiopia, Keffa and Sheka zones of southern Ethiopia, rural Shebedino district, South Ethiopia which showed that per capita per day water consumption was lower in households where child had diarrhea [25,26]. This is might be due to households with adequate amount of water provides them for better personal hygiene and environmental sanitation and hence reduces under five-diarrhea [27].

Children whose mothers/care takers wash their hand with water and soap were less likely to develop diarrhea compared to children whose mothers/care takers wash their hand with water only. This is in agreement with the findings from Bangladesh [28], Ghana [14,29], south west Ethiopia [20] and Dejen district, North West Ethiopia [30]. This could be explained by since they are the main care givers of the child and hand washing with soap clears microorganisms in their hand highly compared with those washing their hand with water only.

Being a community based study, considering EDHS core based standard questionnaire, and assessing the effect of different demographic, social-economic, environmental, and behavioral factors of under-five diarrhea were the strengths of the study.

Recall bias on two weeks occurrence of diarrhea may under estimate the magnitude, respondents difference in perception (definition of diarrhea, behavioral and environmental factors) and since it was a cross sectional study; it is difficult to detect seasonal variations and to setup temporal relationship were the limitations of the study.

Conclusion

This study revealed that the prevalence of under-five diarrhea was relatively high. The major predictors of under-five diarrhea were residence, mothers/care takers educational status, water source of the households, per capita water consumption of the households, and mothers/care takers hand washing method.

Recommendation

Promotion of females education, constructing improved water source so as to provide safe water and increase their daily water consumption, and giving health education program to the community about hand washing methods to use soap at recommended times were essensial to improve under-five diarrheal morbidity in the community.

Summary

There are limited information on the prevalence and socio-economic, demographic, behavioral and environmental factors of diarrhea among children under five years of age that were conducted so far in Tigray Region.

It was exhaustive study that was tried to assess environmental, behavioral, socio-economic and demographic factors. Identifying factors associated with under five diarrhea is very crucial for effective early implementation of child health intervention programs, for policy formulation and general assessment of resource requirements and intervention prioritization.

Declarations

Research Ethics Approval and Consent

Ethical approval and clearance was obtained from Institutional Ethical Review committee (IRC) of Addis Ababa University Medical faculty, School of Public Health. Full verbal consent was obtained from the mothers/caretakers of the child after clear explanation was given about the aim of the study. Confidentiality and privacy was also maintained during data collection, analysis and reporting.

Availability of Data and Materials

We declare that this research is our original work that all resources and materials used for the research have been duly acknowledged. The data sets used during the current study are available from the corresponding author on reasonable request.

Funding Statement

Not applicable

Competing Interests

The authors declare that they have no competing interests

Authors' Contributions

TA designed, lead the study and draft the manuscript. SH helped in write up of the proposal, analysis of the data and writing up of the final report. BBG helped literature review, coordinate the data collection process analysis/data management. MA critically review the manuscript. All authors were participated in the data analysis and drafting of the manuscript. All authors read and approved the final manuscript.

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Acknowledgment

The hospitality and cooperation of Woreda Laelay-Maychew officials, the populations of study site in general and data collectors and study participants in particular were also highly appreciated.

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