Determinants of diarrheal disease among under five Children in Robe Hospital, Bale Zone, Oromia, Ethiopia: Case-control study

Muhammedawel Kaso[1*], Abebe Nigussie[2] and Ismael Kalayu[1]

[1]Department of Public Health, College of Health Sciences, Arsi University, Asella, Ethiopia

[2]Digital Health Activity (DHA)/JSI, Addis Ababa, Ethiopia

*Corresponding author: Muhammedawel Kaso[1] Email:- muhammedawel@gmail.com

Abstract

Background: In African countries including Ethiopia, each child on average hurts from five episodes of diarrhea per year. Therefore, this paper focuses on determinants of diarrheal diseases among under five children in Robe Hospital, South East Ethiopia from May-August, 2018.

Methods: Health Facility based unmatched case-control study design was conducted in Robe Hospital. Interviewer administered questionnaire was used to collect data. Epi-Info version 7 and SPSS version 20 were used for data entry and analysis respectively. The proportion of case and control was assumed to 1:2 and by using the Epi Info Version 7 software the sample size was 594 (198 cases and 396 controls). Factors associated with diarrheal disease were analyzed using bivariate and multivariate logistic regression. In bivariate logistic regression, p-value of <= 0.25 was considered for enrolling variables to multiple logistic regression. Adjusted odds ratios with 95% confidence interval was calculated using a logistic regression model to controlled confounding effect and to determined predictors of the outcome. P-value < 0.05 was considered as cutoff point for statistically significance variables.

Results: Multivariate logistic regression showed that presence of improved latrine [AOR: 0.35 95% CI: (0.21, 0.58)], mother/caretaker hand washing at critical time [AOR: 0.50 95% CI: (0.26, 0.95)], maternal history of diarrhea [AOR: 3.02 95% CI: (1.30, 7.02)] and age of child being 12-23 months [AOR: 4.37 (2.22, 8.62)] were found to be significant factors for under five years children's diarrheal disease.

Conclusions: The results of the study showed that factors; namely age of children, presence of improved latrine, mother history of diarrhea in the past two weeks and hand washing at critical time were significantly associated with diarrhea among children less than five years of age. Overall, educating mothers focusing on sustained behavioral changes in the use of improved latrine and hand washing at critical time is an important intervention for the prevention and control of diarrhea among children.

Keywords: Determinants, diarrheal disease, under five children, case-control, Robe, Ethiopia

1. Introduction

Diarrhea is the common fecal-oral disease in under five children and is defined as the occurrence of three or more loose or liquid stools per day (Rahul B, 2017; Fisseha K. A, 2018; Mekonnen H. W, 2018; Tedros F, 2018; Nakarin Ch, 2009). Diarrhea is an infection in the intestinal tract, which can be caused by a variety of bacterial, viral and parasitic organisms particularly Rotavirus is one of the major pathogens (Kang R, 2015; Sarker R. H. M, 2014).

Globally, there are around 1.7 billion cases of diarrheal disease and 1.5 million deaths of under the age of five years in developing countries each year (Sundar Sh. B, 2016; Levine C. A, 2013; Rani Dh. S, 2013; Mengistie

B, 2013; Gao W, 2012). Diarrhea is the second leading cause of child morbidity and mortality, especially in the developing countries (Bezatu M, 2012; Yoshito K, 2017; Waqas, M, 2018; Randremanana V. R, 2016; Lúcia A. E, 2015; Chowdhury F, 2015; Dey K. S, 2013) and one out of every five deaths among children is caused by diarrhea (Fontoura M. V, 2018). In Sub-Saharan Africa, diarrhea accounted for 25 to 75% childhood morbidity and 50% childhood mortality. As a Sub-Saharan African country Ethiopia has experienced childhood diarrhea and the associated high morbidity and mortality (Azage M, 2015; Gebre G. B, 2017; Azage M, 2016).

Global burden of diarrheal disease was estimated 842 000 deaths in LMICs are caused by inadequate WASH, representing 58% of total diarrheal deaths, and 1.5% of the total disease burden. Separated out by individual risk factor, 502 000 deaths can be attributed to unsafe and insufficient drinking-water, 280 000 deaths result from inadequate sanitation, and another 297 000 are due to inadequate hand washing. Because some people are exposed to multiple risk factors, the sum of deaths attributable to individual risk factors is different from when the risk factors are considered together. Diarrheal deaths among children under-five have more than halved from 1.5 million in 1990 to 622 000 in 2012. Inadequate WASH accounts for 361 000 of these deaths, or over 1000 child deaths per day (WHO, 2014**)**.

The frequency and severity of diarrhea are aggravated by lack of access to sufficient clean water and sanitary disposal of human waste, inadequate feeding practices and hand washing, poor housing conditions, and lack of access to adequate and affordable health care (Gerald T, 2001). Better hygiene practices, particularly hand washing with soap and the safe disposal of excreta could reduce the incidence of diarrhea by 35% [Gerald T, 2001; EDHS, 2011; Fischer Walker C. L, 2013; FMoH, 2005; WHO, 2000).

Studies have shown that, in developing countries like Ethiopia, the occurrence of diarrheal disease among under five children is complex and the relative contribution of each factor varies as a function of interaction between socioeconomic, environmental, and behavioral variables. In many developing countries socio-demographic characteristics like maternal and child age and availability of sanitary facilities, hygienic practices, flies infestations, and regular consumption of street food are also some determinant factors for the occurrence of diarrheal disease (Yassin K, 2000; Oadi K, 2005).

Despite remarkable progress in the reduction of under-five mortality, childhood diarrheal disease is still a leading cause of mortality and morbidity (Alebel A, 2018; Pham M. D, 2013; Lanata F. C, 2013) and it continues to pose a daunting public health challenge, especially in under five children from developing countries (Pate A, 2010). Although diarrheal disease is common across all economic settings, it has the most potential to cause severe consequences when resources and medical care are limited or when co-morbidities are present (Woroszyło C, 2018). Therefore, investigating on determinants of diarrheal disease is advantageous to prevent diarrheal disease and to be cost effective as per different area and populations factors associated which is Robe town.

2. Materials and Methods

2.1. Study area, study design and period

The study was conducted in Robe Hospital, which is found in Bale Zone, Oromia Region, at the South-East of the country. It is located at 430km far away from capital city of Addis Ababa. Robe hospital is one of the hospitals among five hospitals in Bale Zone. It serves an estimated total population of

656, 519 with 136, 775 households and 98, 478 under-five children. Institutional based unmatched case-control study was conducted from May to August, 2018 in Robe Hospital.

2.2. Study population

The cases studied where children with diarrheal disease (under five children with three or more loose or liquid stools per day considered as case) in the under-five OPD of Robe hospital coming for treatment and the controls were recruited from children on the same under-five OPD for causes other than diarrheal infection and from EPI room those who came for vaccination during study period.

2.3. Sample size and Sampling techniques

The sample size calculation was based on the following assumptions: P1=proportion of disease with child faeces disposal not in latrine, P2= proportion of non-disease with child faeces disposal not in latrine from similar study conducted in Haramaya district child faeces disposal not in latrine were as the main predictor of outcome (diarrhea); the sample were 52.4 % for cases and 39.3 % for control (Siraj R, 2015). The sample size was determined using double population formula using the following assumptions; P1=0.524, $\mathbf{Z}_{\propto/2}$=1.96 (95% CI) and P2=0.393, $\mathbf{Z\beta}$ =0.84 (power of 80%), the proportion of case and control was assumed to 1:2 and by using the Epi Info Version 7 software the sample size was 540 (180 cases and 360 controls). So, by adding 10% non-response rate; the final sample size was **594 (198 cases and 396 controls).**

2.4. Sampling technique

Children less than five years of age visited Robe Hospital were enrolled into the study. The sampling technique used in this study was purposive

sampling. The case was purposively taken based on pre-defined criteria and for each case, two consecutive controls were taken. The recruitment of controls and cases were carried out after their parents consented to participate in the study.

2.5. Data collection procedures and quality control

Data were collected using structured questionnaire developed from WHO, UNICEF, EDHS and previously published research articles elsewhere on similar study to collect information on socio demographic and economic characteristics, environmental conditions and behavioral aspects for both cases and controls.

The data was collected by trained female diploma nurses and public health professionals who work in other area (other than study area) and speak both Amharic and Afaan Oromo. The reason for selected female data collectors were for simplicity of communication during data collection since most female in the study area may prefer to communicate with female health workers than male. Supervision was conducted during entire data collection period by the investigator and supervisors who are degree holder health professionals who speak Amharic and Afaan Oromo language. To assure quality of data; different activities were conducted prior to data collection, during data collection, during data entry and data analysis. The questionnaire was translated first to local language (Afan Oromo) to make data collection process simple and translated back to English language to check its consistency. Training was given for data collectors and supervisors for two days on the study instrument and data collection procedure. The training mainly focused on interviewing techniques, and emphasis was also given for questions that need careful attention.

Pretesting was done on data collection instrument before conducting the study for quality of data in 5% of the sample population at Obera Health Center which is found in Sinana Woreda. Based on the result of the pretest modifications were made on data collection tool and average time required for interview was decided. During data collection time, a clear introduction that explains the purpose and objectives of the study were provided to respondents. A close supervision, honest communication and on spot decisions were conducted during data collection. Each data collector checked the questionnaires for completeness before leaving each study participant. All filled questionnaires were reviewed at the end of the day for omissions, clarity and consistency by the supervisors and the principal investigator to assure the quality accordingly.

2.6. Data processing and analysis

Collected data was checked for completeness and constancy and coded manually. Data was entered in to Epi-info version 7 and then exported to SPSS version 20. Data was recoded, computed, counted and proportional were done. First univariate analysis was done to calculate frequency, mean and standard deviation. Bivariate logistic regression was done to identify candidate variable for multivariate logistic regression. In bivariate logistic regression p-value of less or equal to 0.25 was considered for enrolling variables to multiple logistic regression. Multiple logistic regression was done to identify independent predictors of diarrheal disease. Crudes odds ratio with 95% confidence intervals were used to determine the strength of association between independent variables and dependent variable. Finally, adjusted odds ratios with 95% confidence interval was calculated using a logistic regression model to control confounding effect and to determine

predictors of the outcome. P-value less than 0.05 was considered as cutoff point for statistically significance variables.

2.7. Ethical approval and consent to participate

Approved written permission was obtained from ethical review committee of Rift Valley University Public Health Department. Another letter of permission was obtained from Oromia Regional Health Bureau. Only verbal consent was obtained from parents of study participants after explaining the purpose and objectives of the study. Confidentiality of the participants also maintained. Finally, participation in the study was on voluntary bases and they would be informed about the right not to participate or withdraw at any time.

3. Results

3.1A: Socio-demographic and economic characteristics

Out of 594 (198 cases and 396 controls) sample size, these 576 (192 cases and 384 controls) were enrolled in the study with a response rate of 96.9%. There were 106 (55.2%) case male and 86 (44.79%) case female.

Cases were mostly children between 12 and 23 months' age (55%) and (16.14%) under five children were within 6-11 months' age category. More than half of respondents 301 (52.25%) had 4-5 family size (Table 1A).

Table 1A: Socio-demographic and economic characteristics of diarrhea among children under five years of age in Robe Hospital, South east Ethiopia, 2018

Variable	Cases (%)	Controls (%)
No. of under five children in the house hold		
One	92(47.9)	242(63.0)
Two	95(49.47)	135(35.1)
More than two	5(2.6)	7(1.8)
Sex of the child		
Male	106(55.2)	188(49)
Female	86(44.8)	196(51)
Age of the child		
0-5 months	2(1)	8(2.1)
6-11 months	31(16.1)	105(27.3)
12-23 months	106(55.2)	114(29.7)
24-35 months	29(15.1)	69(18)
>35 months	24(12.5)	88(22.9)

3.1B: Socio-demographic and economic characteristics

Majority of 448 (77.77%) respondents were Oromo by ethnic group and 270 (46.87%) were Muslim by religion. Among respondents of case, their educational status 85 (42.27%) were primary education and the least 15 (7.81%) were illiterate (Table 1B).

Table 1B: - Socio-demographic and economic characteristics of diarrhea among children under five years of age in Robe Hospital, South east Ethiopia, 2018

Variables	Cases (%)	Controls (%)
Family size		
<=5	153(79.68)	290(75.52)
>5	19(9.89)	94(24.47)
Marital status of the mother		
Never Married	1(0.52)	7(1.82)
Married	182(94.79)	368(95.83)
Divorced/Separated	6(3.12)	4(0.1)
Widowed	3(1.56)	5(1.3)
Educational level of mothers/care givers		
No formal education	15(7.81)	37((9.6)
Primary education (1-8)	85(44.27)	156(40.6)
Secondary education (9-12)	64(33.33)	115(29.9)
Above secondary education	28(14.58)	76(19.8)
Educational level of father		
No formal education	5(2.60)	10(2.60)
Primary education (1-8)	54(28.12)	112(29.16)
Secondary education (9-12)	71(39.97)	115(29.94)
Above secondary education	57(29.68)	141(36.71)
Ethnicity group of parents		
Oromo	158(82.28)	290(75.52)
Amahara	26(13.54)	74(19.27)
Sidama	6(3.12)	9(2.34)
Other*	2(1.04)	11(2.86)
Religion of the parent		
Muslim	92(47.91)	178(46.35)
Orthodox	73(38.02)	127(33.07)
Protestant	26(13.54)	76(19.79)
Catholic	1(0.52)	3(.78)
Occupation of the mother		

Housewife	102(53.12)	234(60.93)
Farming	3(1.56)	10(2.60)
Merchant/Trade	40(20.83)	67(17.44)
Private Organization employ	12(6.25)	20(5.20)
Government employ	33(17.18)	50(13.02)
Daily Laborer	2(1.04)	3(.78)
Average monthly income of families		
<500	32(16.7)	40(10.4)
501-1000	49(25.5)	92(24)
1001-2000	35(18.2)	82(21.4)
>=2001	76(39.6)	170(44.3)
Age of mother/care giver		
<20	15(7.8)	32(8.3)
20-24	51(26.6)	89(23.2)
25-29	52(27.1)	94(24.5)
30-34	45(23.4)	102(26.6)
>=35	29(15.1)	67(17.4)

Note: * Include Tigre and Gurage ethnicity.

3.2. Environmental exposure characteristics of the respondents

Majority of respondents (91.1% cases and 99.7% controls) had latrine and 58% case and 61.2% control of respondents were used their private owned latrine. Out of total participants; 539 (93.57%) were used pipe system drinking water as their main source and only 2.95 % were used unprotected well as a source of drinking water. Regardless of solid waste management; 299 (51.9%) were dispose in garbage, whereas only 28 (4.86%) were disposed in to open field (Table 2).

Table 2: Environmental exposure characteristics of diarrhea among children under 5 years of age in Robe Hospital, South east Ethiopia, 2018

Variable	Cases (%)	Controls (%)
Presence of latrine		
Yes	175(91.1)	383(99.1)
No	17(8.9)	1(0.3)
Ownership of the latrine		
Private owned	111(57.8)	235(61.2)
Shared with neighbor	64(33.3)	148(38.5)
Type of latrine		
Pit latrine without slab/open pit	146(76)	246(64.1)
Pit latrine with slab	20(10.4)	116(30.2)
Ventilation improved latrine	9(4.7)	21(5.5)
Years since latrine constructed		
<6 months	5(2.6)	8(2.1)
6 months-2years	33(17.2)	66(17.2)
2-3 years	34(17.7)	87(22.7)
>3years	103(53.6)	222(57.8)
Solid waste disposal method		
Pit	65(33.9)	124(32.3)
Open field	13(6.8)	14(3.6)
Burning	21(10.9)	39(10.2)
Garbage	93(48.4)	207(53.9)
Sources of water for drinking		
Piped system	176(91.7)	363(94.5)
Protected well/spring	10(5.2)	10(2.6)
Unprotected well/spring	6(3.1)	11(2.9)

3.3A: Hand washing factors for diarrhea among children under 5

Eighty percent (80%) of mothers/caretakers of index child in both cases and controls reported that they were washed their hands with soap or ash in past 24-hour prior to survey (one day prior to the study time). The most frequently mentioned occasions to wash their hands with soap or ash by mothers or caregivers in both cases and controls, were before eating 92.2% and 95.1%, after eating 87% and 95.6%, after visiting latrine 84.4% respectively. There were significant difference on reported hand washing before eating between cases and controls (Table 3A).

Table3A: Hand washing factors for diarrhea among children under 5 years of age in Robe Hospital, South east Ethiopia, 2018

Variables	Cases (%)	Controls (%)
Hand washing time #		
After visiting latrine	162(84.4)	342(89.1)
After cleaning Childs buttock	55(28.6)	116(30.2)
Before preparing food	120(62.5)	289(75.3)
Before eating	177(92.2)	365(95.1)
After eating	167(87)	367(95.6)
Before feeding a child	62(32.3)	129(33.6)
After handling water for storage	1(0.5)	11(2.9)
After sleep getting up	124(64.6)	220(57.3)
Hand washing substitutes		
Soap and Water	146(76)	315(82)
Only Water	46(24)	69(18)

3.3B: Drinking water factors for diarrhea among children under 5 years of age

More than 95% of respondents in both cases and controls were transported drinking water to the house in a covered container. Among water storage container, high proportions of respondents (135 (69.3%) cases and 282 (73.4%) controls) were used lid or fitted cover. About 120 (62.5%) cases and 266 (69.3%) controls respondents were reported that they have used pouring method to draw water from their drinking water storage container (Table 3B).

Table 3B: Behavioral factors for diarrhea among children under 5 years of age in Robe Hospital, South east Ethiopia, 2018

Variables	Cases (%)	Controls (%)
Transport the collected drinking water to the house		
In covered container	188(97.9)	371(96.6)
In an uncovered container	4(2.1)	13(3.4)
Water storage used only for storing drinking water		
Yes	135(70.3)	290(75.5)
No	57(29.7)	94(24.5)
water storage container has lid or fitted cover		
Yes	133(69.3)	282(73.4)
No	2(1)	8(2.1)
Type of the drinking water storage container		
Jarry-can	118(61.5)	264(68.8)
Plastic bucket	15(7.8)	22(5.7)
Iron bucket	2(1.0)	4(1.0)
Method of drawing water from drinking storage		
Dipping	15(7.8)	24(6.3)
Pouring	120(62.5))	266(69.3)

3.3 C: Behavioral factors for diarrhea among children under 5 years of age

Majority of mothers/caretakers (79.7% cases and 86.7% controls) were feed their child only breast milk up to 6 months' and 46.9% of mother/caretaker in both cases and controls were offer their child with additional diet at 6-months.

Only 4 (4.2%) cases and 14 (3.6%) controls of respondents were treated water used for their drinking purpose. From those respondents who were treated water; the most commonly used methods of water treatment were add chemicals or chlorine bleach 4 (2.1%) in cases and 12 (3.1%) in controls (Table 3C).

Table 3C: Behavioral factors for diarrhea among children under 5 years of age in Robe Hospital, South east Ethiopia, 2018

Variables	Cases (%)	Controls (%)
The child ever breast feed		
Yes	189(98.4)	380(99)
No	3(1.6)	4(1)
Continuation of breast feeding		
< 1 year	59(30.7)	102(26.6)
>=year	130(67.7)	278(72.4)
Supplementary feeding start time		
< 6month	38(19.8)	72(18.8)
At 6 month	90(46.9)	180(46.9)
>6month	64(33.3)	132(34.4)
Child feeding method		
Using hand	38(19.8)	81(21.1)

Using cup and spoon	78(40.6)	187(48.7)
Only cup	17(8.9)	34(8.9)
Bottle	49(25.5)	59(15.4)
Eating by him/her self	10(5.2)	23(6.0)
Unsanitary disposal of child faces		
Used latrine	42(21.9)	81(21.1)
Put in latrine	70(36.5)	162(42.2)
Put/rinsed into ditches	54(28.1)	77(20.1)
Left in open	17(8.9)	41(10.7)
space/Rinse away	9(4.7)	23(6)
Measles vaccination		
Yes (by response of the respondents)	169(88)	297(77.3)
Yes (by checking card)	21(10.9)	79(20.6)
No	2(1)	8(2.1)
Rota vaccination		
Yes (by response the respondents)	179(93.2)	323(84.1)
Yes (by checking card)	9(4.7)	50(13)
No	4(2.1)	11(2.9)

3.4. Factors associated with the occurrence of diarrheal disease

Bivariate analysis was performed to assess the association between each independent variable in occurrence of diarrhea. Variables in the bivariate analysis of socioeconomic and demographic, household sanitation and hygiene characteristics, maternal behavioral conditions and child demographic and health characteristics with respect to relation of diarrhea among under five children; which were found at p-value ≤ 0.25 were further considered in the final logistic regression model. In the bivariate analysis presence of latrine in the household, improved latrine, exclusive breast-

feeding practice, age of child being at 12-23 months and average monthly family income showed statistically significant association with occurrence of diarrhea among under five children. In the final logistic regression, 17 variables with p-value $\leq$ 0.25 were entered into the multivariate model to assess factors associated with occurrence of diarrhea among under five children.

In the multiple logistic regression analysis, the Hosmer- Lemeshow test indicates a $p > 0.05$ which signifies that the overall model fit was good. The result of multivariate analysis showed that four variables were significantly associated with diarrheal disease among under five children. Accordingly, age of child being 12-23 months, presence of improved latrine, mother's history of diarrhea in the past two weeks and hand washing at critical time were factors associated with determinants of diarrhea among under five children.

Children from household who have improved latrine were 65% less likely to develop diarrhea when compared to children from household who have unimproved latrine [AOR: 0.35 95% CI: (0.21, 0.58)]. Children from mothers who wash their hand at critical time were 50% less likely to develop diarrhea when compared to children from mother who did not wash their hand at all critical time [AOR: 0.50 95% CI: (0.26, 0.95)].

The odd of developing diarrhea among children from mother who have history of diarrhea in the past two weeks were 3 times more likely when compared to mother who have no history of diarrhea in the past two weeks [AOR: 3.02 95% CI: (1.30, 7.02)]. In addition, the odd of developing diarrhea among children age 12-23 months were 4.4 times more likely when compared to children age > 35 months [AOR: 4.37 95% CI: (2.22, 8.62)].

Presence of latrine, exclusive breast-feeding practice and family monthly income that were significantly associated in the bivariate analysis; their significance were disappeared in multivariate analysis when confounder was controlled.

However, factors that were associated with diarrhea disease among under five children in other study like education status of mother and father, occupation of the mother and father, latrine year of construction, type of water source, time of collecting drinking water source, method of water drawing, presence of drinking water storage and child feces disposal method, did not showed any statistical significance in this study (Table 4).

Table 4: Factors associated with diarrhea among children under 5 years of age in Robe Hospital, South East Ethiopia, 2018

Variable	Cases	Controls	COR (95% CI)	AOR (95% CI)
Average monthly income of the HH				
<500 ETB	32 (44.4%)	40 (55.6%)	1.79 (1.04-3.06)	1.41 (0.63-3.13)
501-1000 ETB	49 (34.8%)	92 (65.2%)	1.19 (0.77-1.85)	0.99 (0.54-1.83)
1001-2000 ETB	35 (29.9%)	82 (70.1%)	0.95 (0.59-1.42)	0.76 (0.41-1.40)
>=2001 ETB	76 (30.9%)	170 (69%)	1	1
Latrine type				
Improve	29 (17.5%)	137 (82.5%)	0.36 (0.23-0.56)	**0.35 (0.21-0.58)****
Unimproved	146 (37.2%)	246 (62.8%)	1	1
Mother hand washing at all time				
Yes	21 (26.2%)	59 (73.8%)	0.68 (0.39-1.15)	**0.50 (0.26, 0.95)****
No	171 (34.5%)	325 (65.5%)	1	1
Exclusive breast feeding				

For <6 months	36 (43.4%)	47 (56.6%)	1.667 (1.04-2.68)	1.85 (0.98-3.48)
Up to 6 months	153 (31.5%)	333 (68.5%)	1	1
Mother history of diarrheal in the past two weeks				
Yes	17 (47.2%)	19 (52.8%)	1.87 (0.95-3.68)	**3.02 (1.30-7.02)****
No	175 (32.4%)	365 (67.6%)	1	1
Age of child				
0 to 5 months	2 (20.0%)	8 (80.0%)	0.92 (0.18-4.60)	1.16 (0.19-7.21)
6 -11 months	31 (22.8%)	105 (77.2%)	1.08 (5.92-1.98)	**1.23 (5.71-2.64****
12 - 23 months	106(48.2)	114 (51.8%)	3.41 (2.02-5.75)	**4.37 (2.22-8.62)****
24 - 35 months	29 (29.6%)	69 (70.4%)	1.54 (0.84-2.88)	2.10 (0.99-4.47)
> 35 months	24 (21.4%)	88 (78.6%)	1	1

****Statistically significant at p-value <0.05**

4. DISCUSSION

Worldwide, diarrhea is the third cause of disease and the sixth largest cause of death among population of all ages. Globally diarrheal disease is the second leading cause of death in under-five children responsible for 1.7 million morbidity and 760, 000 mortality every year (Abireham A. M, 2018; Girma R, 2008). The aim of this study was to identify determinants of diarrhea among under-five children. After multivariate analysis it was found that four factors remained statistically significantly associated with diarrheal disease.

After multiple logistic regression; one of the predictor variable which determines the risk of exposer to diarrheal disease was age of the child which increases the risk of exposure to diarrheal disease. This finding is consistent with studies conducted in under- five determinants of diarrheal disease (Ssenyonga R, 2009; Mbugua S, 2014; Siziya S, 2013; Shikur M, 2014; Bezatu M, 2013). The risk of diarrheal disease was highest among 12-23 months of age group and this is might be due to more children stop breast milk and starting complementary feeding at this age. During the start of complementary feeding, children develop diarrheal disease due to contamination of the complementary food in addition to children touch all things and take to their mouth. This study was similar to studies conducted in Iraq (Siziya S, 2009) and in Eastern Ethiopia (Bezatu M, 2013) showed that higher risk of diarrhea was observed during the age of 6-11 months; the period when most children start complementary food.

The second predictor variable which affects under-five diarrheal disease was presence of improved latrine. Those study participants having improved latrine had lower risk of exposure to diarrheal disease than those participants having unimproved latrine. The present study was consistent with a study

conducted in, Sebeta Town, Oromia Region, Ethiopia (Muhammed Al, 2016; Semba R D, 2011; Andualem A, 2010). The possible reason for this might be unimproved latrines were associated with operational deficiencies, poor hygiene, offensive smells and flies which is more conducive environment for transmission of diarrhea among under five children. In addition, unimproved creates unsanitary and disheveled conditions which provide favorable environments for diarrheal infection, and also increases the possibility of transmitting pathogens from one infected household member to children`s. Generally, improved latrine is believed to be effective for reducing exposure to fecal pathogens and preventing diseases.

In this study, maternal history of diarrheal morbidity was found to be significant predictors of diarrheal morbidity in children. From the current study those children who had maternal history of diarrhea had higher risk of exposure to diarrheal disease than those children who had not maternal history of diarrhea. This finding was consistent with studies on under five diarrheal disease, showed that maternal diarrhea was independently predictor of under-five childhood diarrhea (42-44- Abdiwahab H, 2016; Mulat G, 2017; Mock N ST, 1993).

Another predictor variable which affect the occurrence of childhood diarrhea in under five children was maternal/caregiver hand washing at critical time. Accordingly, in this study it is showed that, those children who had mother/care giver washed their hand at critical time were lower risk of exposure to diarrheal disease as compared to their counterparts. This finding was similar to studies done in in different areas (45-52- Yesvi Z; Kunal M. K, 2017; Alebel A; Solomon B. G, 2018; Gedamu G, 2017; Zelalem A. A, 2014; Hashi A, 2017; Teklemichael G, 2014). This result is in line with the fact that handwashing at critical time can interrupt the transmission of the

pathogens that cause diarrhea. This is mainly because of simple action of washing hands at critical time decreases the transmission of diarrheal disease thereby decreasing children exposure for consumption of contaminated food and fluids since mothers or caregivers are the primary care giver for their children including preparing their diet and feeding and cleaning their child buttock after defecation.

5. Conclusions and recommendations

The results of this study showed that factors; namely age of children, presence of improved latrine, mother history of diarrhea in the past two weeks and hand washing at critical time were significantly associated with diarrhea among children less than five years of age visiting Robe Hospital.

The Zonal health department with district health office and health extension workers need to continue and strength regular supportive supervision of mothers/caretakers to improve and sustain hand washing at critical times, having improved latrine, and the general sanitary conditions. Coaching mothers by focusing on sustained behavioral changes in the use of latrine integrated with personal hygiene is an important intervention for the prevention and control of diarrhea among children.

Abbreviations / Acronyms

AOR = Adjusted odd ratio, CI = Confidence Interval, COR = Crude Odd Ratio, EDHS Ethiopian Demographic and Health Survey, OR = Odd Ratio, SPSS = Statistical Package for Social Science, UNICEF = United Nations Children's Fund, WHO = World Health Organization

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