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Determinants of Acute Bloody Diarrhoea Among Under-Five Years Age Children in Basoliben Woreda East Gojjam Zone Amhara Ethiopia

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COLLEGE OF MEDICINE AND HEALTH SCIENCES

DEPARTMENT OF EPIDEMIOLOGY AND BIOSTATISTICS

ETHIOPIAN FIELD EPIDEMIOLOGY AND LABORATORY TRAINING PROGRAM (EFELTP)

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BY

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A THESIS TO BE SUBMITTED TO DEPARTMENT OF EPIDEMIOLOGY AND BIOSTATISTICS SCHOOL OF PUBLIC HEALTH COLLEGE OF MEDICINE AND HEALTH SCIENCES BAHIR DAR UNIVERSITY AS A PARTIAL FULFILMENT FOR THE DEGREE OF MASTER OF PUBLIC HEALTH IN FIELD EPIDEMIOLOGY

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Abstract

Background: Bloody diarrhoea is defined as diarrhoea with visible or microscopic blood in the stool and cause severe complications such as septicemia, anemia and Zink deficiency particularly in young children. The 2016 Ethiopian Demographic Health Survey and study conducted in seven low income and middle income countries including Ethiopia showed bloody diarrhea still to be the higher cause of morbidity and mortality in under-five children. So the aim of this study was to identify the determinants of acute bloody diarrhea among under-five children in the study area.

Methods: Facility based unmatched case-control study design was conducted from March 2019 to May 2019 on 312 under five patients. Data were entered in to Epi-Data version 3.1 and exported to Statistical Package for Social Science Version 20 for analysis and Adjusted Odds Ratio with 95% confidence interval was computed and p-value less than 0.05 in multi-variable logistic regression was considered as significantly associated with the outcome variable.

Result: According to the study the determinants of acute bloody diarrhea in children were using water for drinking from unprotected water source(AOR:3.2, CI: 1.52-6.74), human Co-inhabitation with animals (AOR: 2.5, CI: 1.37-4.51), not disposing infants' or children's feces into latrine (AOR: 1.2, CI: 1.02-3.57), under nutrition (AOR: 3.8, CI: 1.66-8.76) and family size of households ≥5 (AOR: 2.1, CI: 1.21-3.72).

Conclusion and recommendation: In this study majority of the determinants of acute bloody diarrhea among under-five children in the study area were environmental related factors such as water for drinking from unprotected source. To reduce the transmission of acute bloody diarrhea in children, the local Government, other stakeholders and partners should invest and work harmoniously for improvement of safe water supply and other hygienic practices.

Key words: Acute bloody diarrhea, Basoliben woreda, determinant, under-five year's age

Acronyms

AOR	Adjusted Odds Ratio
APHI	Amhara Public Health Institute
BOFED	Bureau of Finance and Economic Development
BF	Breast Feeding
CDC	Center For Disease Prevention And Control
CFR	Case Fatality Rate
CI	Confidence Interval
EBF	Exclusive Breast Feeding
EDHS	Ethiopian Demographic Health Survey
EFELTP	Ethiopian Field Epidemiology And Laboratory Training Program
FMOH	Federal Ministry Of Health
HC	Health Center
HH	House Hold
IMNCI	Integrated Management of Neonatal and Childhood Illness
MAM	Moderate Acute Malnutrition
MOFED	Ministry Of Finance and Economic Development
MRN	Medical Registration Number
MUAC	Mid-Upper-Arm-Circumstance
NGO	Nongovernmental Organization
OR	Odds Ratio
PHEM	Public Health Emergency Management

SAM	Sever Acute Malnutrition
SPSS	Statistical Package for Social Science
SNNPR	Southern Nations Nationality People Region
UNICEF	United States International Children's Emergency Fund
VIP	Improved Ventilated Pit
WHO	World Health Organization

Contents

Acknowledgements III
Abstract IV
Acronyms V
Lists of figures ii
1. Introduction 1
1.1. Background 1
1.2. Statement of the problem 2
1.3. Justification of the study 4
1.4. Significance of the study 5
2. Literature review 6
2.1.1. Socio-demographic and economic factors 6
2.1.2. Environmental related factor 7
2.1.3. Behavioral related factors 9
2.2. Conceptual Framework 10
3. Objective 11
4. Methods and materials 12
4.1. Study design and period 12
4.2. Study area 12
4.4. Study population 12
4.5. Eligibility criteria 12
4.6. Variables 13
4.6.1. Dependent Variable 13
4.6.2. Independent Variables 13
4.7. Definitions 14
4.8. Sample size determination and Sampling technique 16
4.8.1 Sample Size determination 16
4.8.2. Sampling technique 16
4.10. Data quality assurance 18
4.12. Ethical Considerations 19
5. Results 20
5.1. Socio-demographic characteristics of participants 20
2. Environmental characteristics of participants 22

5.3. Behavioral characteristics of participants 23
5.4. Underlying morbidity characteristics of participants 24
6. Simple binary logistic regression 25
7. Determinants of acute bloody diarrhea among under-five children 27
8. Discussion 30
9. Recommendation 32
10. Reference 33
11. Annex 37
11.1. Introduction and Informed Consent 37
11.2. Questionnaire 38

Lists of tables

Table 1: Sample size determination for power (double population proportion formula) from previous studies 16
Table 2: Socio-economic and demographic characteristics of participants in Basoliben woreda east Gojjam zone Amhara Ethiopia 2019 20
Table 3: Environmental characteristics of participants Basoliben woreda east Gojjam zone Amhara Ethiopia 2019 22
Table 4: Behavioral characteristics of participants Basoliben woreda east Gojjam zone Amhara Ethiopia 2019 23
Table 5: simple binary logistic regression of acute bloody diarrhea among under-five children in Basoliben woreda east Gojjam zone Amhara Ethiopia, 2019 25
Table 6: predictor Variables associated with acute bloody diarrhea among under-five children in Multi-variable logistic regression in Basoliben woreda east Gojjam zone Amhara Ethiopia, 2019 28

Lists of figures

Figure 1: Conceptual framework.....10
Figure 2: Schemic presentations of sampling procedures 17

1. Introduction

1.1. Background

Diarrhea is passage of loose stool three or more times per day bloody(1,2). There are three clinical types of diarrhoea as: persistent diarrhea lasting more than 14 days, acute watery diarrhea lasting less than 14 days and acute bloody diarrhea lasting less than 14 days (3).

Bloody diarrhea is said to be dysentery which is an infectious gastrointestinal disorder characterized by inflammation of the intestine (4). Dysentry can also be classified in to two based the infectious cases as bacillary dysentry and amoebic dysentry. The bacteria pathogens associated with bloody diarrhea are *species of shigella, salmonella, Escherichia coli pathotypes especially shiga-toxin producing Escherichia coli(EIEC) campylobacter* and *Yersinia enterocolitica*(5). And amoebic dysentry is caused by the *genus Entamoeba histolytica species*(6). Among these pathogens *Shigella dysenteriae type*1 is the pathogen responsible for epidemic bacillary dysentery or bloody diarrhoea.

The common signs and symptoms of bloody diarrhea are sudden onset of diarrhoea with blood and/or pus in the stool, high fever, abdominal or rectal pain. Dysentery can cause severe complications such as septicemia or blood poisoning, rectal prolapsed and hemolytic-uremia syndrome which is a serious condition affecting the kidneys and blood clotting system and can lead to anemia and Zink deficiency bloody diarrhea(7,8)

Dysentery mainly spreads among people through contaminated food and water as well as poor hygiene and sanitation(5). The different factors such as socio-economic factors, poor access to latrine, lack of clean drinking water, poor housing, overcrowding, cohabitation with domestic animals can be associated with dysentry (9).

Dysentery accounts for 9% of the world's deaths. There are an estimated 165 million cases of Shigella infection or bloody diarrhea each year, resulting in some 1.1 million deaths, mostly of children under-five years old world wide(10). According to the 2016 annual report of Federal Ministry Of Health (FMOH) a total of 320,700 dysentery cases were reported from all regions, an increment by 14,106 (4.39%) from 2015. The majority of the cases were reported from Amhara region with 27.9% from the total and with incidence rate of 407/100,000. On the report total Case Fatality Rate (CFR) at the national level was 1% (11).

1.2. Statement of the problem

Globally diarrhea is the second leading cause of infectious morbidity and mortality in children under five years of age next to pneumonia(6,7). Worldwide, children aged less than five years' experience, on average, 3.2 episodes of diarrhea every year (14).Diarrhea has harmful impact on child growth and cognitive development(15). Diarrheal disease cause nearly one in five children deaths(16). It is estimated that there are at least 80 million cases of bloody diarrhoea and 700,000 associated deaths each year worldwide, with approximately 99% of cases occurring in developing countries(16,17) and among these children cover Two thirds of deaths(19).

About 10% of diarrhea episodes in children have blood visible in the stool, and these account for about 15% of diarrhea-associated deaths in this age group worldwide(20). Bloody diarrhea in children can lead to Zinc deficiency which can result in increased severity and prolongation of the duration of the illness(3) In China children less than one years of age are the more affected age groups by bacillary dysentery with the incidence rate of 228.59 cases per 100,000 person-years followed by an average incidence rate of 92.58 cases per 100,000 person-years in 1-4 years age children(21). In Iraq the prevalence of bloody diarrhoea among children is 28%(22). Even if researches done on the same issues in Ethiopia were not found, there were some reports that somehow show the magnitude of bloody diarrhea at national level.

The 2016 annual report of Federal Ministry of Health (FMOH) revealed that a total of 320,700 dysentery cases were reported from all regions. The majority of the cases were reported from Amhara (with 27.9% from total and with incidence rate of 407/100,000) and the total CFR at national level was 1%(11). Amhara Public Health Institute(APHI) annual report of 2018,showed that there were 91,828 bloody diarrhea cases with an incident rate of about 0.4% (23). Basoliben woreda health office annual report of 2018 in under-five children viewed that the incidence of bloody diarrhea in under-five children was 3% (24).

The government has made efforts on management of acute bloody diarrhea in children through IMNCI program. However, researches are limited on determinant of bloody diarrhea among under-five children as the country level.

Diarrhea(bloody diarrhea) has multiple risk factors widely classified as socio-economic, environmental and behavioral related factors(25). Strategies suggested to reduce the disease in different literatures are, Improving sanitation, accessibility to safe food and water supplies,

improving personal hygiene practices, promoting breastfeeding, vitamin-A supplementation, child spacing, nutritional care for children, Cup method of complementary feeding, use of narrow necked water storage container , access of hand washing detergent, Encouraging mothers for their children to be fully vaccinated, availability of refuse disposal and breast feeding were possible methods to alleviate diarrhea in children[1, 24, 25, 26, 27, 28, 29,36].

However, the 2016 EDHS and study conducted in seven low income and middle income countries including Ethiopia showed diarrhea (bloody) still to be the higher cause of morbidity and mortality in under-five children (32). So my study was aimed to identify determinants of acute bloody diarrhea in children in the study area.

1.3. Justification of the study

Prevention and control of acute bloody diarrhea needs identification of behavioral as well as environmental determinants through research. However, researches are limited about the determinants that contribute to the burden of the illness in under-five children in our country specifically in the study area. Therefore researches on the determinants of bloody diarrhea among under-five children will help public health officials as well as the community to implement specific prevention and control mechanism. Thus this study aimed to identify the determinants of acute bloody diarrhea among under-five children in the study area.

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1.4. Significance of the study

The findings of the study generated information about the determinants of acute bloody diarrhea among under-five children. Thus, the study will be helpful for the responsible bodies of policy makers to address health policy issues, stakeholders and partners to develop local intervention plan, and to implement intervention measures. The findings of the study can support the health professionals to create awareness on the community on acute bloody diarrhea. The study can also be used as a reference for interested researchers to do further study in the woreda.

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2. Literature review

2.1.1. Socio-demographic and economic factors

In a study of bloody diarrhea among children in Baghdad Iraq, Children living in rural areas demonstrated significantly higher rates of bloody diarrhoea, compared to those of living in urban area. Children of illiterate mothers demonstrated significantly higher rate of bloody diarrhoea compared to children of highly educated mothers (university or more). In families using river water and tank water, the children showed significantly higher rate of bloody diarrhoea compared to those using tap water as a household source of water. Significantly higher bloody diarrhoea was detected among children who were on exclusive bottle feeding(22).

In Iran on acute diarrhea in Children showed that mother's employment, and economical status of the household were significantly associated with acute diarrhea in children less than five years old(33).

In a study conducted on Diarrhea Among Children and the Household Conditions in a Low-Income Rural Community in the Jordan Valley revealed that, mother's age, mother's educational status, mother's employment type, family income and family size were variables that were significantly associated with diarrhea in children in the study area(34).

A study conducted on factors associated with diarrhea among under-five children in Zambia showed that the odds of having diarrhea among the children in the 12-23 months age group were 2.55 times more than those in the other age groups. Women who were less educated had 1.61 times risk of being associated with diarrhea. The children who resided in rural areas had increased risk of having diarrhea compared to their urban counterparts. Those that had incomplete vaccinations against childhood illnesses (including diarrhea) had 2.18 odds of having diarrhea compared to those vaccinated(13).

According to study done in Umuahia, Abia, Nigeria on prevalence and associated factors of diarrhea in children 0-5 years old, those having siblings and children who do not have, it was found that the risk of having diarrhoea among children who have one or more siblings was higher than those who are the only child, showing significant association between birth order and diarrhoea(12).

The study conducted in Nyarugenge district, Rwanda revealed that, children whose mothers/caretakers had never attended and attended primary school; children who were not vaccinated for Rota virus were significantly risk for diarrheal diseases(30).

The study conducted in Zambia demonstrated that age of children, residence and mother's educational status were significantly associated with diarrhea among the under-five children in the study area(35).

The study conducted at Debre Birhan north Shoa on prevalence and associated factors of diarrheal diseases among under five children suggested that occupation of parents, and diarrheal history of mother were risk factors for the occurrence of diarrhea in under-five children(36).

In a study conducted on determinants of acute watery diarrhoea among children aged 6months to 59 months in Chire district southern Ethiopia in 2018 GC showed that, Age of index children, family size, infants' faeces disposal places, vitamin-A deficiency, maternal history of recent diarrhoea were the major factors to cause acute diarrhoea among children aged 6-59 months in the district(26).

2.1.2. Environmental related factor

The study done on causes and risk factors for diarrhea among children less than five years of age admitted to Dong Anh Hospital, Hanoi, Northern Vietnam; using stool as fertilizer or open defecation was 3.9 times risk to cause the disease than using latrine, the odds of developing diarrhea was 1.5 higher among children who had no hand-washing for the child before eating compared to those who wash hands after latrine, irregular hand-washing by mothers after going to toilet was six times risk to cause the disease than regular hand washing after toilet. Irregular hand-washing by mother after helping the child to defecate was 2.3 times risk than regular hand washing by mother after helping the child to defecate and hand washing by mother with water only instead of with soap and water was 2.9 times more risk to develop diarrhea in children (28).

The study on Diarrhea among Children and the Household Conditions in a Low-Income Rural Community in the Jordan Valley revealed that toilet utilization, tap water availability, sufficient supply of drinking water, clean water reservoir were associated on diarrhea in the study area(34).

The study held on Prevalence of diarrhoea, and associated risk factors, in children aged 0-5 years, at two hospitals in Umuahia, Abia, Nigeria revealed that, type of latrine used,

mothers/care givers hand washing practice and type of water source used in the study area were associated factors for diarrhea in children. (12)

In a study conducted on Environmental factors associated with acute diarrhea among children under five years of age in Derashe district , Southern Ethiopia revealed that the occurrence of diarrhea was significantly associated with lack of latrine ownership was 2.43 times more risk to cause diarrhea than those owned latrine**,** , improper disposal of infant feces was3.35 times more risk to cause diarrhea and lack of improved water sources was 1.98 times more risk to develop diarrhea in children(37). Study in Jigjiga district showed children whose households use water from unprotected source were 1.6 times more risk for diarrhea than whose households use from protected source(38).

In Babile district the occurrence of diarrhea in children was 5.16 times higher in children whose family use water from unprotected source(39). The research in West Gojjam, showed that poor disposal of infants' feces and water for drinking from unprotected source were risks to have diarrhea in children(40). In Harena Buluk woreda Oromia region living with animal in the same house was 8.3 times more likely to develop diarrhea in children than those who had separated animal house(41).

The study conducted in Dejen district north west Ethiopia results revealed that inappropriate disposal of infant feces was 3.7 times more risk than those dispose in to latrine, tube well water source was2.59 times more risk to develop diarrhea than those who used pipe water source.(13). On a study conducted on Assessment of Prevalence and Related Factors of Diarrheal Diseases among Under-Five Years Children in Debrebirehan Referral Hospital , Debrebirehan Town , North Shoa Zone, showed that living with cattle in one house was found to be 1.97 times more risk to develop diarrhea than those who live with separated animal house. Rural residency was 2.53 times more risk to develop diarrhea than urban residency and water storage in wider naked container was 1.304 times more risk than water storage in narrow naked storage (36).

A study on Prevalence and determinants of acute diarrhea among children younger than five years old in Jabithennan, District, and Northwest showed that time taken to fetch water(less time take), type of water storage(jerican) were protective for diarrhea in children in the study area(29).

2.1.3. Behavioral related factors

In Kenya Storage of drinking water separate from water for other use was 0.41 times less likely to cause acute bloody diarrhea than not separated. Hand-washed after last defecation was 0.24 times less likely to cause the disease than no hand wash after last defecation(42)

In rural area of Shebedino district southern Ethiopia mode of feeding by cup was 2.13 times more likely to develop diarrhea than feeding by spoon, and malnourished children were 4.06 times more likely to develop diarrhea than those well nourished(28). On a study conducted on Prevalence and determinants of acute diarrhea among children younger than five years old in Jabithennan District, Northwest Ethiopia, factors such as Methods of complementary feeding with Cup and Cleansing materials used to wash hands with Soap and water were protective factors for diarrhea in the study area(29).

On the study conducted on Childhood Diarrheal Diseases and Associated Factors in the Rural Community of Dejen District , Northwest Ethiopia 2014, revealed that Vit. A supplemented children 6 months to 59 months of age were 1.09 times less likely to develop diarrhea than those who were not supplemented and use of soap and water to wash hand of mothers/care givers was 0.62 times less likely to cause diarrhea in children (31) and in other study lack of vitamin-A supplementation was 3.44 times risk to cause diarrhea in children(26) and other study showed that, vaccinated children were 0.45 times less likely to develop diarrhea than those unvaccinated (13). On a study in Nepal nutritional status was identified as the determinant of diarrhea in children (43).

2.2. Conceptual Framework

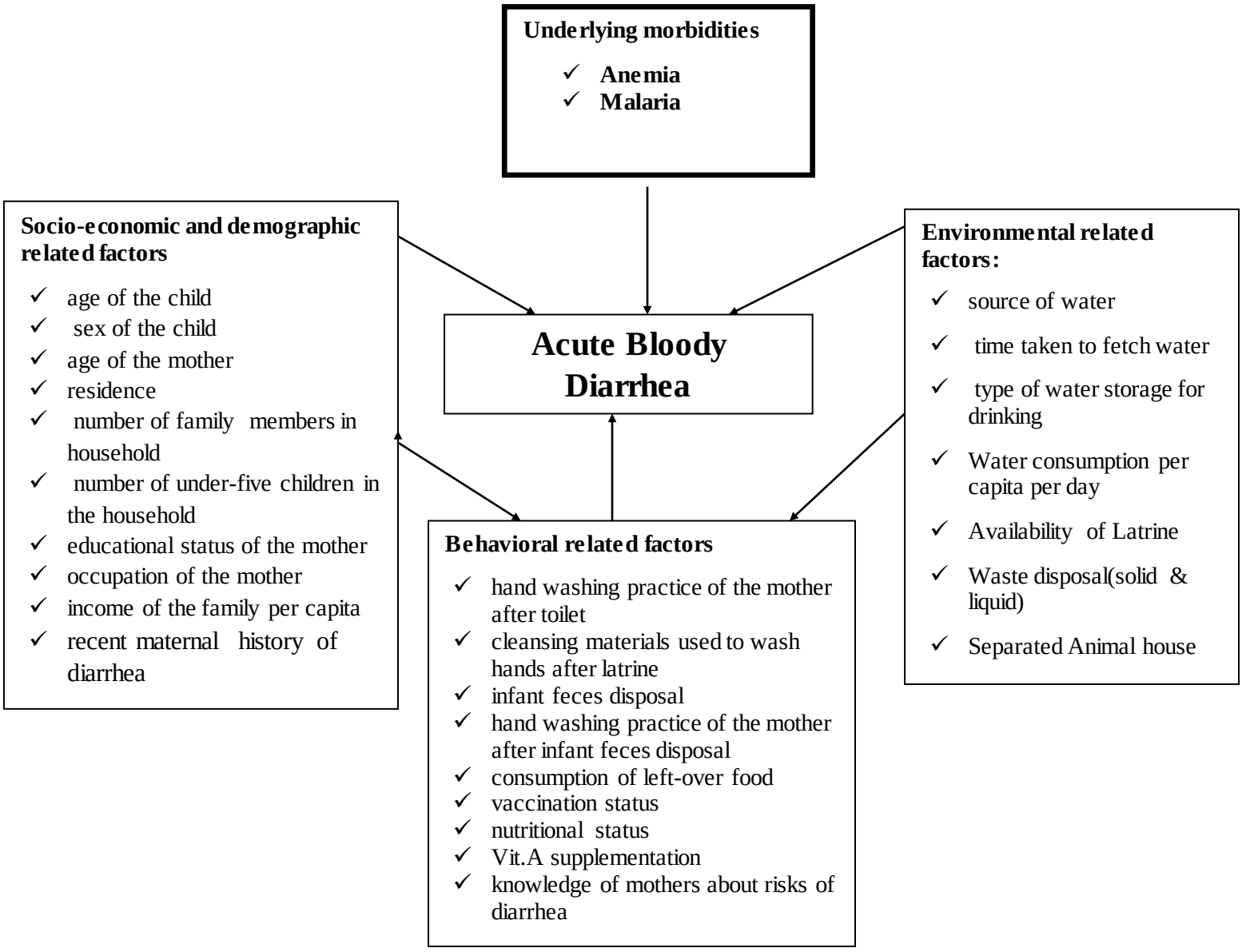

Figure 1: Conceptual framework

These variables are adapted from different literatures [2, (37), (29),(44),35,(26),33,(38),(28),(45)].

3. Objective

To identify the determinants of acute bloody diarrhea among under-five age children in Basoliben woreda east Gojjam zone Amhara Ethiopia, from March 2019 to May 2019

4. Methods and materials

4.1. Study design and period

Facility based unmatched case-control study design was conducted from March to May, 2019.

4.2. Study area

The study was conducted in Basoliben woreda east Gojjam zone Amhara Ethiopia. The woreda is one of the eighteen woredas in East Gojjam zone. Its boundaries are to the east and north Aneded woreda, to the west Gozamin woreda and to the south Oromia regional state separated by Abay River. Its capital Yejubie is located 27km away from Debre Markos, 292km away from Bahir Dar and 307 km away from Addis Ababa. The woreda has 25 kebeles with 05 health centers and 25 health posts (the three are urban health posts). According to the woreda Finance and Economic Development Office projection for the year 2019, the woreda has a population of 169,085 of which 22, 826 are under-five years' children.

4.3. Source population

All under five patients who visited all health centers of Basoliben Woreda from March 2019 to May 2019 who were permanent residents of the woreda except patients of acute watery, persistent and chronic diarrhea.

4.4. Study population

Under-five years' patients that were selected during their visit from all health centers of the woreda from March 2019 to May 2019.

4.5. Eligibility criteria

Inclusion Criteria

Case- All under-five years' patients who visited all health centers of Basoliben woreda with acute bloody diarrheal diseases from March 2019 to May 2019

Control-All under-five years' patients who visited all health centers of Basoliben woreda with any disease other than any types of diarrheal diseases from March 2019 to May 2019

Exclusion Criteria

Under-five patients who visited health centers accompanied by any person other than their mothers, whose mothers had verbal communication problem and who were severely ill.

4.6. Variables

Two types of variables were used in the study, namely dependent variable and independent variables.

4.6.1. Dependent Variable

Acute bloody diarrhea among under-five years age children

4.6.2. Independent Variables

Socio-demographic and economic factors: age of the child, sex of the child, birth order of the child , age of the mother, residence, number of family member, number of children younger than five years old, educational status of the mother, occupation of the mother, income of the family and recent mother history of diarrhea

Environmental characteristics or factors: source of water, time taken to fetch water, type of water storage, separated container for drinking water, availability of latrine, hand washing facility near the latrine, waste disposal, separated animal house

Behavioral related factors: hand washing practice, cleansing materials used to wash hands, vaccination status of the child, vitamin A supplementation of the child with in 6months, nutritional status of the child and knowledge of mothers about diarrhea.

Underlying morbidities: malaria and anemia

4.7. Definitions

Acute bloody diarrhoea: bloody diarrhea that lasts less than fourteen days(1).

A case: was defined as a person of under-five year's age patient whose diagnosis was acute bloody in health centers of Basoliben woreda during the study period.

Monthly income per capita: the average monthly income per capita in Ethiopia is 873 dollars yearly which is expected to be birr 600(44).

A control: was defined as a person of under-five years' age patient whose diagnosis was other than diarrheal diseases in health centers Basoliben woreda during the study period.

Water source: was classified as protected water source and unprotected water source. Protected water source is when drinking water source is protected from outside contamination, in particular from contamination with fecal matter. This includes protected spring, protected dug well, bottled water and piped water sources. Unprotected water source when drinking-water source is from pond, river; unprotected dug well and unprotected spring(26).

Waste: includes both liquid and solid wastes but not human excreta(46).

Amount of water consumption will be categorized as households that used 20 litter and above per individual per day and households that used less than 20 litter per individual per day for drinking, food preparation and washing facilities (46).

Vaccination status was classified as complete vaccination, partially and not vaccinated based on the EPI program but does not include vaccinations give during campaigns

Nutritional status: was measured by using MUAC and by observing the presence of bilateral pitting foot edema. Therefore children with MUAC greater than 125mmare considered as well nourished, children with MUAC between 115mm and 125mm are considered as moderately acute under nourished and children with MUAC less than 115mm or with bilateral pitting edema are said to be severely acute under nourished(47).

Index child: a child who was included in the study(26).

Good knowledge of mothers about major risk factors of diarrhea: mothers who mentioned at least three major risk factors such as no vaccination, lack of exclusive breast feeding, using unsafe water for drinking and food preparation, contaminated food, lack of hand washing practice with soap at critical times, eating improperly handled food and lack of latrine facility(26).

Poor knowledge of respondents about major risk factors: Refers to respondents who mentioned at most two risk factors stated above(26).

Co-inhabitation with animals: refers to not separating animal house.

Leftover food: refers to the uneaten edible remains of a meal after any has finished eating

Respondents: mothers who are interviewed for their children

4.8. Sample size determination and Sampling technique

4.8.1 Sample Size determination

The Sample size was determined based on sample size calculation for double population proportions formula using EPI Info version:7.0 software with the assumptions of 95% confidence interval (CI), control to case ratio 3:1, AOR 2.43, power 80 % , percent of control exposed 20.61 % , from previous study(44). The sample size was 283 (71 cases and 212 controls) and with 10% non- response rate of 29 was 312 where 78 were cases.

Table 1: Sample size determination for power (double population proportion formula) from previous studies

Variables	Percent of cases with exposure (p1)	Percent of controls exposed (p2)	Ratio (unexposed to exposed)	AOR	Assumptions		Sample size	Ref.
					CI	Power ($1-\beta$)		
Latrine owning	38.7	20.61	3	2.43	95%	80%	283	(44)
Age of children	48.7	28.1	3	2.43	95%	80%	250	(24)
Water source	37.2	15.6	3	3.21	95%	80%	184	(39)

These studies were taken as reference considering acute bloody diarrhea and other types of diarrhea have similar risk factors. Latrine owning was selected because it was the exposure variable that gave the highest sample size of cases and controls among the other variables from previous studies.

4.8.2. Sampling technique

Systematic sampling technique was used to select the 312 study cases and controls. All health centers of the woreda were selected for the study. Cases and controls were proportionally allocated to each health center based on the annual expected number of under-five children in its catchment. To estimate the population of under-five children from the total population of the study area 13.54% was taken as the conversion factor from Amhara Bureau of Finance and Development for 2019 budget year. Finally total cases and controls allocated for each health center were as shown below (figure.2).

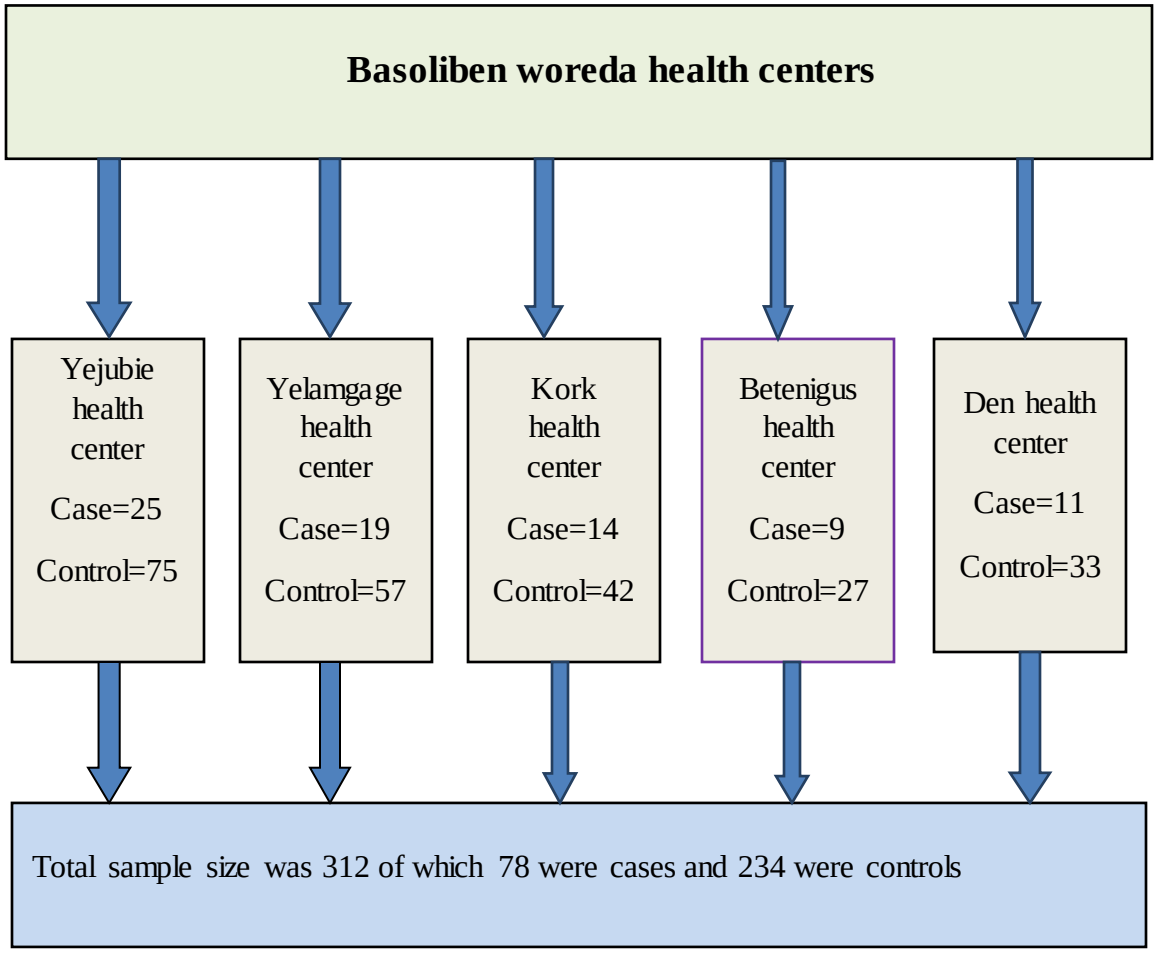

Figure 2: Schemic presentations of sampling procedures

4.9. Data collection procedures

Data were collected by face to face interview of respondents using structured questionnaire developed from different similar literatures to include possible variables that addresses the objective of the study. The questionnaire included four characteristics of the participants like socio-demographic, environmental, behavioral and medical related factors. Data were collected by five trained nurses that work at under-five OPD and monitored by two supervisors and the principal investigator.

4.10. Data quality assurance

Before data collection the questionnaire was translated into local language (Amharic) from its English version. To improve the quality of this data collection tool, pretest was conducted on 5% of the sample size in Aneded woreda which is the nearest woreda of the study area. Data collectors were supervised while collecting the data by the principal investigator and other two supervisors so that technical support was provided accordingly. Data were checked as much as possible frequently for completeness and consistency throughout the data collection period.

4.11. Data Processing and Analysis plan

Data were checked for completeness, coded and entered into Epi-Data Version 3.1, cleaned and then exported into SPSS version 20 for data analysis. Descriptive analysis was used to determine the characteristics of cases and controls. The strength of association between acute bloody diarrhea and independent variables (covariates) was expressed in odds ratio (OR) with 95% confidence interval. Bi-variable analysis was done and all variables that were significant at p-value $\leq$ 0.20 were entered into multi-variable binary logistic regression model to control the potential confounding and effect modification. Back ward regression model was used to select the variables. Finally, independent variables with p-value less than 0.05 in multi-variable binary logistic regression were considered as determinants of acute bloody diarrhea. The model goodness of test was checked by Hosmer and Lemeshow goodness of the fit (p-value > 0.05) to test whether the required assumptions for the use of the mult-variable binary logistic regression are fulfilled. Lastly the findings of the study have been presented by narration, and tables.

4.12. Ethical Considerations

The study protocol was approved by Research Ethics and Approved by Bahir Dar University Institutional Review Board (IRB) college of medicine and health science. Official letters of cooperation was written to Basoliben woreda health office to obtain cooperation in facilitating the study. The woreda health office also wrote Official letters of cooperation to all selected health facilities. Respondents (mothers) were provided information on the purpose of the study, its procedures and their right to refuse or decline participating in the study at any time. Both Verbal and written consent was obtained from the respondents (mothers) and study subjects confidentiality was assured as the information they give will not be disclosed or used for any purpose other than the study.

5. Results

5.1. Socio-demographic characteristics of participants

A total of 312 respondents (mothers) for the age of under-five children participated in the study with 100% response rates. Among children included in the study 33 (42.3%) of cases, and 78 (33.3%) of controls were age groups of 12-23 months. From the total children 38 (48.7%) of cases, and 130 (55.6%) of controls were males. Out of the total of mothers 54 (69.2%) of cases and 150 (64.1%) of controls were unable to read and write. Among the mothers 72 (92.3%) of cases and 189(80.8%) controls were married. With regard to family size 42 respondents (53.8 % cases, and 86 (36.8%) of controls had family size of greater than five (Table .2).

Table 2: Socio-economic and demographic characteristics of participants in Basoliben woreda east Gojjam zone Amhara Ethiopia 2019

Variables	Category	Status				Chi-square
		Cases (n=78)		Controls(n=234)		
		Count	percent	count	percent	
Age of children	< 6 months	6	7.7	30	12.8	0.20
	6 t-11 months	21	26.9	53	22.6	
	12 - 23 months	33	42.3	78	33.3	
	24 - 35 months	13	16.7	40	17.1	
	36 - 59months	5	6.4	33	14.1	
Sex of children	male	38	48.7	130	55.6	0.36
	female	40	51.3	104	44.4	
Age of the mother	< 20 years	7	9.0	9	3.8	0.27
	20 -34 years	58	74.4	174	74.4	
	≥ 35	13	16.7	51	21.8	
Birth order of children	first	24	30.8	88	37.6	0.53
	second	24	30.8	68	29.1	
	third and above	30	38.5	78	33.3	
Residence	urban	24	30.8	83	35.5	0.54
	rural	54	69.2	151	64.5	
Family size of the house hold	<5	36	46.2	148	63.2	0.01
	>=5	42	53.8	86	36.8	
Number of under -five children in the household	one	64	82.1	204	87.2	0.35
	Two and above	14	17.9	30	12.8	
Educational status of the mother	unable to read and write	54	69.2	150	64.1	0.71

	able to read and write	7	9.0	30	12.8	
	Primary (1-8)	9	11.5	24	10.3	
	Secondary and above	8	7.7	30	7.3	
Occupation of the mother	housewife	72	92.3	189	80.8	0.23
	Other	6	5.1	45	6.0	
	Other	7	9.4.1	28	13.0	
Monthly income of the household per head	< 600 birr	33	42.3	75	32.1	0.13
	>=600 birr	45	57.7	159	67.9	
Recent maternal history of diarrhea	Yes	8	10.3	9	3.8	0.42
	No	70	89.7	225	96.2	

2. Environmental characteristics of participants

Among the respondents 61(78.2% cases) and 212 (90.6% controls) use water from protected water source and 56(71.8%, cases) and 197 (84.2% controls) had latrine. From the total 43(55.1% cases) and 181(77.4% controls) had separated animal house (table.2).

Table 3: Environmental characteristics of participants Basoliben woreda east Gojjam zone Amhara Ethiopia 2019

Variables	Category	Status				Chi-square
		Cases(n=78)		Controls(n=234)		
		Count	Percent	Count	Percent	
Source of water	Protected	61	78.2	212	90.6	0.01
	Unprotected	17	21.8	22	9.4	
Time taken to fetch water	< 30 minutes	67	85.9	205	87.6	0.85
	≥ 30 minutes	11	14.1	29	12.4	
Water consumption per day percapita	< 20 litter	40	51.3	90	38.5	0.06
	≥ 20 litter	38	48.7	144	61.5	
Type water storage	Narrow necked	57	73.0	196	83.8	0.05
	Not narrow necked	21	27.0	38	16.2	
Latrine owning	Yes	56	71.8	197	84.2	0.02
	No	22	28.2	37	15.8	
Separated animal house	Yes	43	55.1	181	77.4	<0.001
	No	35	44.9	53	22.6	
Solid waste disposal	With pit	20	25.6	79	33.8	0.41
	Mixed	52	66.7	142	60.7	
	Open field	6	7.7	13	25.6	
liquid waste disposal	With pit	18	23.1	60	5.6	0.88
	Mixed	55	70.5	161	68.8	
	Open field	5	6.4	13	5.6	

5.3. Behavioral characteristics of participants

Out of children 63 (80.8% cases) and 217 (92.7%) were well nourished. Among respondents 49 (62.8% cases) and186 (79.5% controls) reported as they disposed children's feces in to the latrine (table.2).

Table 4: Behavioral characteristics of participants Basoliben woreda east Gojjam zone Amhara Ethiopia 2019

Variables	Category	Status				Chi-square
		Cases(n=78)		Controls(n=234)		
		Count	Percent	Count	Percent	
Frequency of mother's hand wash after toilet	always	48	61.5	164	70.1	0.33
	Some times	20	25.6	43	18.4	
	No	10	12.8	27	11.5	
Cleansing material to wash hand After toilet	With soap and water	12	17.6	62	30.0	0.23
	With ash and water	2	2.9	10	4.8	
	With water only	54	79.4	135	65.2	
Children's feces disposal in to the latrine	Yes	49	62.8	186	79.5	0.005
	No	29	37.2	48	20.5	
Frequency of dispose children's feces in to the latrine	Always	39	79.6	166	88.8	0.25
	Some times	10	20.4	21	11.2	
Hand wash of mother after children's feces deposal	Yes	47	95.9	180	96.2	0.212
	No	2	4.1	7	3.8	
Frequency of mother 's hand wash after children's feces disposal	Always	30	63.8	150	83.3	1.00
	Some times	17	36.2	30	16.7	
Children left over food consumption	Yes	12	15.4	20	8.5	0.13
	No	66	84.6	214	91.5	
Vaccination status	Completed	50	64.1	170	72.6	0.21
	Partially vaccinated	27	34.6	58	24.8	
	Not vaccinated at all	1	1.3	6	2.6	
Vitamin A supplementation	Yes	44	56.4	163	69.7	0.05
	No	34	43.6	71	30.3	
Nutritional status	Well	63	80.8	217	92.7	0.005

	Under	15	19.2	17	7.3	
Knowledge of mother about	Good	23	29.5	91	38.9	0.175
major risks of diarrhea	Poor	55	70.5	143	61.1	

5.4. Underlying morbidity characteristics of participants

Among children participated 13 (16.7% cases) and, 39 (16.7% controls) had known their HIV status and one from cases and one from controls were HIV positive. Regarding to malaria only five children (3 cases and 2 controls) had malaria and only three children (2 cases and 1 control) had anemia.

6. Simple binary logistic regression

To select candidate variables for multi-variable binary logistic regression, simple binary logistic regression was done for each predictor variable with the outcome variable.

In the analysis variables such as family size of the household, water source and nutritional status were candidates for the occurrence of acute bloody diarrhea (table.5)

Table 5: simple binary logistic regression of acute bloody diarrhea among under-five children in Basoliben woreda east Gojjam zone Amhara Ethiopia, 2019

Variables	Category	Status		COR(95% CI)	p-value
		Cases Count (%)	Controls Count (%)		
Age of children	< 6 months	6(7.7)	30(12.8)	0.76(0.21-2.74)	0.672
	6-11 months	21(26.9)	53(22.6)	0.38(0.13-1.11)	0.078
	12-23 months	33(42.3)	78(33.3)	0.36(0.13-0.99)	0.050
	24-35 months	13(15.4)	40(17.1)	0.47(0.15-1.44)	0.186
	36 -59 months	5(6.4)	33(14.1)	1.00	
Family size	≥ 5	42(55.1)	86(36.8)	2.01(1.20-3.37)	0.008
	< 5	36(44.9)	148(63.2)	1.00	
Monthly income of the household per head	< 600 ETB	33(42.3)	75(32.1)	1.56(0.92-2.63)	0.100
	≥ 600 ETB	45(57.7)	159(67.9)	1.00	
Type of water source	unprotected	17(21.8)	22(9.4)	2.69(1.34-5.38)	0.005
	Protected	61(78.2)	212(90.6)	1.00	
Water consumption per capita per day	< 20	40(51.3)	90(27.8)	1.68(1.01-2.82)	0.048
	≥ 20 lt	38(48.7)	144(72.2)	1.00	
Type of water storage	Not narrow necked	21(26.9)	38(16.2)	1.90(1.03-3.49)	0.039
	Narrow necked	57(73.1)	196(83.8)	1.00	
Latrine owning	No	23(29.5)	37(15.8)	2.23(1.22-4.06)	0.017
	Yes	55(70.5)	197(84.1)	1.00	
Animal house separated	No	35(44.9)	53(22.6)	2.78(1.62-4.78)	<0.001
	Yes	43(55.1)	181(77.4)	1.00	

Infants/children's feces disposal	No	29(37.2)	48(20.5)	2.29(1.31-4.01)	0.004
	Yes	49(62.8)	186(79.5)	1.00	
Left-over food consumption	Yes	12(15.4)	20(8.5)	1.95(0.90-4.19)	0.089
	No	66(84.6)	214(91.5)	1.00	
Vit.A supplementation Within six months	No	34(43.6)	71 (30.3)	1.77(1.05-3.01)	0.033
	Yes	44(56.4)	163(69.7)	1.00	
Nutritional status	Under nourished	14(17.9)	17(7.3)	2.79(1.31-5.97)	0.004
	Well nourished	64(82.1)	217(92.7)	1.00	
Knowledge of mothers about risks of diarrhea	Poor	55(70.5)	143(61.1)	1.52(0.88-2.65)	0.137
	Good	23 **(**29.5**)**	91(38.9)	1.00	

7. Determinants of acute bloody diarrhea among under-five children

Variables with p-value ≤ 0.20 in bi-variable logistic regression were selected for mult-variable logistic regression analysis.

From the total variables entered in the multi-variable logistic regression, five predictor variables had significant association with acute bloody diarrhoea (Table.6).

The odds of developing acute bloody diarrhea among children whose households use water from unprotected source were 3.2 times higher compared with whose households use from protected source (AOR: 3.2, CI: 1.52-6.74).

The odds of having acute bloody diarrhea among children whose households had not separated animal house were 2.5 folds higher than those whose households had separated (AOR: 2.5, CI: 1.37-4.51).

The odds of developing acute bloody diarrhea among children whose households did not dispose children's feces in to the latrine were 1.2 times higher than those whose households disposed into the latrine (AOR: 1.2, CI: 1.02-3.57).

Under nourished children were 3.8 times higher to develop the disease compared to those who were well nourished (AOR: 3.8, CI: 1.66-8.76).

The odds of developing acute bloody diarrhea among children whose households had a family size of greater than or equal to five were 2.1 times higher than those whose family size was less than five (AOR: 2.1, CI: 1.21-3.72).

Table 6: predictor Variables associated with acute bloody diarrhea among under-five children in Multi-variable logistic regression in Basoliben woreda east Gojjam zone Amhara Ethiopia, 2019

		Characteristics			
Variables	category	cases	Controls	COR	AOR
Age of children in month	< 6 months	6(7.7)	30(12.8)	0.75(0.21-2.74)	
	6-11 months	21(26.9)	53(22.6)	0.38(0.13-1.11)	
	12-23 months	33(42.3)	78(33.3)	0.35(0.13-0.99)	
	24-35 months	13(15.4)	40(17.1)	0.46(0.15-1.44)	
	36 - 59 months	5(6.4)	33(14.1)	1.00	
Family size	≥ 5	42(55.1)	86(36.8)	2.0(1.19-3.37)*	2.1(1.21-3.72)*
	< 5	36(44.9)	148(63.2)	1.00	1.00
Monthly income of the household per head	< 600 ETB	33(42.3)	75(32.1)	1.6(0.92-2.63)	
	≥ 600 ETB	45(57.7)	159(67.9)	1.00	
Type of water source	Unprotected	17(21.8)	22(9.4)	2.7(1.34-5.38)*	3.2(1.56-6.74)*
	Protected	61(78.2)	212(90.6)	1.00	1.00
Water consumption per capita per day	< 20	40(51.3)	90(27.8)	1.7(1.00-2.82)*	
	≥ 20 lt	38(48.7)	144(72.2)	1.00	
Type of water storage	Not narrow necked	21(26.9)	38(16.2)	1.9(1.03-3.49)*	
	Narrow necked	57(73.1)	196(83.8)	1.00	
Latrine owning	No	23(29.5)	37(15.8)	2.2(1.22-4.06)*	
	Yes	55(70.5)	197(84.1)	1.00	
Animal house separated	No	35(44.9)	53(22.6)	2.8(1.62-4.78)**	2.5(1.37-4.51)*
	Yes	43(55.1)	181(77.4)	1.00	1.00
Left-over food consumption	Yes	12(15.4)	20(8.5)	1.9(0.90-4.19)	
	No	66(84.6)	214(91.5)	1.00	
Vit.A supplementation Within six months	No	34(43.6)	71 (30.3)	1.8(1.05-3.01)*	
	Yes	44(56.4)	163(69.7)	1.00	

Infants/children's feces disposal	No	29(37.2)	48(20.5)	2.3(1.31-4.01)*	1.2(1.02-3.58)*
	Yes	49(62.8)	186(79.5)	1.00	1.00
Nutritional status	Under nourished	14(17.9)	17(7.3)	2.8(1.31-5.97)*	3.8(1.66-8.76)*
	Well nourished	64(82.1)	217(92.7)	1.00	1.00
Knowledge of mothers about risks of diarrhea	Poor	55(70.5)	143(61.1)	1.5(0.88-2.65)	
	Good	23 **(**29.5**)**	91(38.9)	1.00	

*-statistical significant variables at $p<0.05$

**-statistical significant variables at $p<0.001$

8. Discussion

According to the study, Water from unprotected source, human co-inhabitation with animals, not disposing children's feces in to latrine, under nutrition and larger family size were the determinants of acute bloody diarrhea in children in the study area.

In this study water for drinking from unprotected water source was one of the predictors of acute bloody diarrhea among under-five children. This finding agrees with similar studies done in Mayo Ireland (48), Baghdad (22), Limpopo Valley (49), Derashe District (44), Jigjiga district(38), Geze Gofa district (50), Babile district(39), West Gojjam (40), and Dejen district (51). This could be due to the fact that protected water source improves human health by ensuring quality of water used for drinking which has a positive influence in prevention of diarrhea. In the contrary water from unprotected source could be exposed to contamination with different infectious agents of diarrheal diseases.

Human Co-inhabitation with animals was a predictor which had significant association with acute bloody diarrheal disease. This finding is supported with a similar studies conducted at Harena Buluk Woreda Oromia (52) and Debre Birhan town (36). The possible reasons could be that if animals co-inhabited with human beings, may increase possibility of contamination of human environment. Because as human beings live very close to domestic animals, the opportunity to contaminate water, food and fingers through their excreta could be very high . This occasion could increase the chance of transmission of pathogens that can cause diarrhea.

This study revealed that households who did not dispose infants'/children's feces into the latrine tended to increase the development of childhood bloody diarrhea. This finding agrees with similar studies held in Derashe District (44), Chire district (26) West Gojjam (40) and Dejen district (51). The reason could be due to the fact that if the feces of children is not disposed into the latrine and contaminate the compounding, because young children defecate in their living environment, it may get contact with the food and water they consume by different mechanism such as by flies and other vehicles. Since human fecal matter is full of diarrheal disease causing microorganisms it leads to spread of the disease. This can also, may justify that the presence of latrine alone cannot be guarantee for prevention of the disease unless there is safe disposal of children's feces in to the latrine.

In the study under nutrition was an important predictor of acute bloody diarrhea among children. This finding coincides with studies in Nepal (43), and Shebedino district (28). This could be that malnutrition and diarrhea have bidirectional relationship. Regarding to malnutrition, it can impair the immune function of children by reducing the protective effect of skin and mucus membrane that can prevent from contracting the disease. Therefore malnutrition can predispose children into diarrhea.

In this study large family size was one of the determinants of acute bloody diarrhea in children. This finding is consistent with studies in Chire District (26) and in Jordan Valley (34). The reason could be that as the number of family size increases the attention and the whole care given for children by their parents may be decreased, because the capacity of the household to give care would be shared in to the large family size memberships. This can make children vulnerable to contamination.

Strength and limitation

The strength of this study is that it involved all health centers of the woreda. The limitation of this study is that since it had been conducted at facility, it lacked field observation. The study might have been biased because of the drawbacks of case control study such as recall bias. Night visitors were not included in the study.

Conclusion

In this study majority of the determinants of acute bloody diarrhea among under-five children in the study area were environmental related factors such as water for drinking from unprotected source, human co-inhabitation with animals and not disposing children's feces in to latrine.

9. Recommendation

To reduce the transmission of acute bloody diarrhea in children, children of households that consume water for drinking from unprotected source should be addressed by the Government, other stakeholders and partners for safe water supply. Health professionals should make Community awareness about risks of co-inhabitation with animals for diarrhea in children. In part of hygiene and sanitation, the community should be encouraged to build the latrine and mothers should be motivated as well to dispose infants' or children's feces into the latrine as usual habit. Health education, assessment and early management of malnutrition by health professionals at the community and facility level should be strengthened. Large family size as a risk of diarrhea especially in children must be made aware in the community and health activities to control family size must be improved.

Other interested researchers can conduct research on the similar issue at community level and on magnitude of the disease.

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11. Annex

11.1. Introduction and Informed Consent

Hello. My name is _____ I am on behalf of Endawoke Kebede, student of Bahir Dar University Department of Epidemiology and Biostatistics. He is conducting a research for the partial fulfillment of masters of public health in field epidemiology on "determinant factors of acute bloody diarrhea among in children younger than five years old in Basoliben woreda". Your child is selected randomly to participate in this study and there are others who are going to be selected randomly in the woreda. Therefore, I am going to ask you some questions about those factors associated with acute bloody diarrhea and related issues about the research. He has received permission from Bahir Dar University institute of health science, Basoliben woreda health office and cluster health center to conduct this study. I would very much appreciate your participation in this interview. This information will help the government and NGOs to plan health services. We assure that the interview process will not bring any harm to you and your family. Whatever information you provide will be kept strictly confidential, and will not be shared with anyone other than the investigator. Participation in this study is voluntary, and if we should come to any question you don't want to answer, just let me know and I will go on to the next question; or you can stop the interview at any time. However, we hope you will participate in the study since your views are important.

At this time, do you want to ask me anything about the study before the interview?

Would you be willing to participate? Yes No

Signature of the respondent: _____

Interviewer name:_____

Signature:_____

Date:_____

Date ----------

Respondent's No-------

11.2. Questionnaire

Kebele----------cluster health center name----------

Name of the data collector ----------signature ----------

I. Study participant's /subject's status

1. Case
2. Control

II. Relation of the respondent to the index child: only children that come with their mothers will be enrolled and the respondents are only mothers of the index children.

PART I. SOCIOECONOMIC AND DEMOGRAPHIC CHARACTERISTICS

Ser.no.	Questions	Response	Remark
101	Age of the index child	---------month(s)	
102	Sex of the index child	1. Male 2. Female	
103	Age of the mother	----------years	
104	Birth order of the index child	1. First 2. Second 3. Third and above	
105	Residence	1. Urban 2. Rural	
106	Number of family members in the household	----------	
107	Number of under-five children in the household	----------	
108	Educational status of the mother	1. Unable to read and write 2. Able to read and write 3. Primary (1to 8) 4. Secondary (9 to 12) 5. Certificate & above	
109	Marital status of the	1. Single	

	mother	**2. Married** **3. Divorced** **4. Widowed**	
110	**Occupation of the mother**	**1. House wife** **2. Farmer** **3. Merchant** **4. Governmental worker** **5. Daily laborer** **6. Other specify**	
111	**Monthly Income of the family per capita**	**----------in Ethiopian birr**	
112	**Mother's Recent history of diarrhea**	**1. Yes** **2. No**	

Part II environmental factors

Ser.no.	Questions	Response	
201	**Source of water for drinking**	**1. protected** **2. unprotected**	
202	**Time taken to fetch water (for one trip)**	**----------minutes**	
203	**Water consumption per capita/day for daily purpose**	**----------liters**	
204	**Type of water storage for drinking**	**1. Narrow necked** **2. Not narrow necked**	
205	**Does the HH have latrine?**	**1. Yes** **2. No**	
206	**Does the Household Separate animal house**	**1. Yes** **2. No**	
207	**How does the HH dispose solid waste?**	**1. With pit** **2. Mixed** **3. Compound**	
208	**How does the HH dispose liquid waste?**	**1. With pit** **2. Mixed** **3. Compound**	

Part III behavioral related factors

Ser.no.	Questions	Response	Remark
301	How often does mother practice hand washing after latrine	1. Always 2. Some times 3. No	
302	What does the mother use cleansing materials to wash hands?	1. With soap and water 2. With ash and water 3. With water only	If the answer for question '301' is '3' skip to '303'
303	Does the mother dispose infant/child faeces in to the latrine	1. Yes 2. No	For all children feces
304	How often does the mother or dispose infant/child faeces in to the latrine	1. Always 2. Some times	If the answer for question '303' is '2' got question '307'
305	Does the mother wash hand after disposing children's feces in to the latrine	1. Yes 2. 2. No	
306	How often does mother practice hand washing after infant/child feces disposal	1. Always 2. Some times 3. No	
307	Has the child consumed left-over food within the past two weeks	1. Yes 2. No	
308	What is the Vaccination status of the child (for age>9 months)	1. Completed 2. Partial 3. Not vaccinated	For regular vaccination only
309	Has the child/infant been supplemented with Vit A within the last 6 months (for age >6 months)	1. Yes 2. No	

310	**The nutritional status of the child**	**1. Well nourished** **2. Moderately nourished** **3. severely malnourished**	
311	**What are the major risks for diarrhea in children?**	**1. ----------** **2. ----------** **3. ----------** **4. ----------** **5. ----------** **6. ----------** **7. ----------**	

IV. Underlying factors

Ser No.	Questions	Response	Remark
401	**Does the child/infant have malaria?**	**1. Yes** **2. No**	**Fill from reg. book**
403	**Is the child anemic?**	**1. Yes** **2. No**	**Fill from reg. book**

Amharic Version

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310	□□□□/□ □□□□ □□□ □□□ □□□□/□□□ □□□	**1.** □□□□ □□□ **2.** □□□□□□ □□□□ □□□□ □□□ **3.** □□□ □□□□ □□□□ □□□	

311	□□□□□□ □□□□□□ □□□□□ □□□□□/□□□□□□ □□□□□ □□□□**?** **(**□□□□□□□ □□□□□□**)**	**1.** ---------- **2.** ---------- **3.** ---------- **4.** ---------- **5.** ---------- **6.** ---------- **7.** ----------	

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401	□□□/□ □□□ □□□ □□□□□□□□/□□□**?**	**1.** □□ **2.** □□□	
402	□□□/□ □□□ □□□ □□□ □□□□/□□ □□**?**	**1.** □□ **2.** □□□	

Declaration

I, the undersigned, declared that this thesis is my original work and has never been presented by another person in this or any other University and that all the source materials and references used for this thesis have been duly acknowledged.

Name Endawoke Kebede

Signature ----------

Date of submission ----------

The thesis has been submitted for examination with my approval as university advisors.

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Advisor 2: Mr. Taye Abuhay	----------	----------
Internal examiner :Dr.Mluken Azage	----------	----------
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