Environmental factors affecting childhood diarrheal disease among under-five children in Jamma District, South Wello zone, northeast Ethiopia

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Abstract

Background

Globally, diarrhea is the leading causes of morbidity and mortality among <5years children and it contributes for the deaths of approximately one million children every year. In Ethiopia, diarrhea is the second cause of under-five mortality and morbidity. However, in the study area the study was very limited. Therefore, this study was assessed the prevalence of diarrhea and associated factors among <5years of age in Jamma district, Northeast Ethiopia.

Methods

A community based cross-sectional study was conducted from August 15 to September 15, 2017 in Jamma district, South Wello zone, northeast Ethiopia. Using systematic random sampling technique 614 households were selected and a pretested structured questionnaire was used to collect the data. A multivariate logistic regression analysis was used to investigate factors associated with diarrheal disease. Adjusted Odds Ratios (AOR) with the corresponding 95% Confidence Interval (CI) was used to show the strength of associations and variables with P-values of <0.05 were considered statistically significant.

Results

In this study, the prevalence of diarrhea among under-five children was 23.1% (95% CI: (19.4, 26.5)). Living in rural area (OR:2.75, 95% CI (1.33,5.66)), absence of latrine (OR:4.80, 95% CI (2.39,9.60)), absence of hand washing facility (OR:2.45, 95% CI (1.53,3.93)), unprotected drinking water source (OR:2.68, 95% CI(1.54,4.68)), improper waste disposal practices (OR:3.86, 95% CI (2.38,6.26)), and source of drinking water, improper waste disposal, and child age were notably associated with childhood diarrheal disease. Therefore, encouraging hand washing practice and proper waste disposal in the district would minimize the burden of diarrheal disease.
Background

Globally, about 1.5 million under-five children were died due to diarrheal disease (1).

Approximately 84% of the global burden of diarrheal disease is experienced by children under the age of five years (2).

This burden is disproportionately high among children of low and middle-income countries. Nearly half of the deaths from diarrhea among young children occur in Africa, where diarrhea is the largest cause of morbidity and mortality (3).

An estimated 100 million episodes of diarrhea occurs each year among <5 years children (4).

A total of five episodes of diarrhea occur every year in a child living in Africa and 800,000 deaths occur due to diarrhea and dehydration (5).

Diarrhea accounts 25% to 75% of childhood diseases and contributes for 14% and 16% of total childhood outpatient visits and hospital admissions, respectively (6).

In addition, it predisposes children to malnutrition, which makes children highly susceptible to other infections (7).

Diarrheal disease causes 16% of deaths in African among <5 years children (8).

According to World Health Organization (WHO) 2014 report, 13% of children had diarrhea within 2 weeks preceding the survey (9).

The occurrence of diarrheal disease depends on several factors includes: malnutrition, poor personal hygiene, environmental problems, water availability and quality, unhygienic feeding practices, improper use of latrines, early discontinuation of breastfeeding, child’s age, maternal education, and household income (10).

Evidences about the magnitude of diarrheal disease and the significant
predictors in the study area was scarce, so this study was aimed to determine the prevalence and factors associated with childhood diarrheal disease.

Methods

Study design and period
Community based cross-sectional study design was conducted from August 15 to September 15, 2017.

Study area and population
Jamma district is one of the 21 districts of South Wello administrative Zone of the Amhara National Regional State, Ethiopia. Based on 2007 population and housing census, Jamma has a total estimated population of 144,409. Of the total population, under-five children constitutes 19,784 (13.7%) and 131,399 (90.9%) of population lives in rural areas. The district has 6 health centers and 22 health posts. The Study populations were all households with at least one under-five child.

Sample size and sampling procedure
The required sample size was calculated using the assumption of P=0.23 which is taken from similar study, margin of error 5%, Z value of 1.96 for 95% Confidence Interval (CI), design effect of 2 and 10% contingency. Then the final sample size determined was 614. Among 23 kebeles six kebeles were selected randomly and 20 gots (smaller administrative units) were selected from the 6 chosen kebeles and all households that have at least one child were included in the study. In case of presence of more than one under-five children, lottery method was used to choose one child per household.

Variable of the study
The dependent variable, childhood diarrheal disease was defined as the presence of loose or watery stool for ≥3 times during a 24 hour period reported from mother/caregiver 2 weeks prior to the survey. Independent variables like socio-demographic: family income,
family size, number of children, parental education, parental occupation, marital status, sex, age of child, maternal age, place of residence and religion, behavioral factors: water drawing and storage method, hand washing practice, feeding practice, and duration of breast feeding practice, environmental factors: type of water source, distance of the water source, amount of daily water consumption, availability and functionality of latrine, and presence of livestock in the house, and other factors like nutritional status of the children were used to assess diarrhea morbidity in the district.

Data collection procedures
Structure interviewing technique was used to collect the data. Mothers/caregivers were interviewed on the occurrence of diarrheal disease within the past two weeks prior to the data collection. Nutritional status of the children was determined by mid-upper arm circumference (MUAC) for children age between 12-59 months. Child length and height was measured according to the child age. Child length was measured on lying down (recumbent) position for children under the age of 2 years and height was used for children beyond 2 years. Thin close was used to cover the length board for child comfort.

Data management and analysis
Data was cleaned, coded, and entered to Epi-info version 7 and transferred to SPSS for analysis. Summary measures like mean was calculated for continuous variables. Variables with P<0.2 were entered for multivariable analysis. Variables with P<0.05 with 95% confidence interval were used to identify significant factors of diarrheal disease. Adjusted Odds ratio (AOR) was used to measure the strength of association and goodness of fit was checked by Hosmer and Lemeshow test.

Results
Socio-demographic characteristics
A total of 614 households were included in the study with a response rate of 100%. More
than 86% of households had only one under-five child in the family and the mean family size was 4.8 (±1.56SD) persons. The larger proportion of respondents 586 (95.4%) were biological mothers. Of 614, 565 (92%), 582 (94.9%) were married and housewives, respectively. Regarding with religion, 341 (55%) were Christian by religion. The mean age of the mothers/caregivers was 29.8 (±6.4) years (Table 1).

**Environmental characteristics**

Of 614 households, 560 (91.2%), had floors made of mud/sand/dug, majority of the households, 441 (71.8%) had latrine. Regarding their source of water, 388 (63.2%) of households got from protected spring and pipe water. Most of the households, 337(54.9%), dispose waste in an open dump. There was no hand washing facility in 355 (57.8%) of the households around their toilets (Table 2).

**Behavioral characteristics**

Majority of mothers/caregivers, 346 (56.4%), were partially breastfed their children. Out of 614 respondents, 584 (95.1%) respondents were used a container with narrow opening store water. Six hundred seven (98.9%) respondents used a covered container to fetch water. Most of the respondents, 472 (76.2%) took water from drinking storage container by pouring (Table 3).

**Child demographic, nutritional and health characteristics**

There were slightly more male 330 (53.7%) children than females. The mean age of the children was 21.9 (SD±14.3) months. The vast majority of the children, 561 (91.4%), were well nourished.

Findings from this study showed that 142 children had experienced diarrhea in the last two weeks preceding the survey, giving a prevalence of 23.1% (95% CI, 19.4% - 26.5%). Children in the age group of greater than 23 months had the highest prevalence of
diarrhea followed by the age group of 6 - 23 months (Table 4).

**Factors affecting childhood diarrhea**

Several factors were independently associated with diarrheal disease. The odds of developing diarrhea among rural children were 2.75 [AOR: 2.75, 95%CI (1.33, 5.66)] times compared to their counter parts. Children from households with no toilet facility were 4.8 [AOR: 4.8, 95% CI (2.39, 9.60)] times higher odds of developing diarrhea than children from households who had toilet facility. The odds of developing diarrhea was 2.45 [AOR: 2.45, 95% CI (1.53, 3.93)] times higher among children whose households had not hand washing facility compared to their counter parts. Children with unprotected drinking water source had 2.68 [AOR: 2.68, 95% CI (1.54, 4.68)] times higher odds of diarrhea than children with protected water sources. Children with open dumped waste around the house had 3.86 [AOR: 3.86, 95% CI (2.38, 6.26)] times higher odds of diarrhea compared to their counter parts. Children aged from 6 to 23 months were 2.46 [AOR: 2.46, 95%CI (1.49, 4.05)] times higher odds of diarrhea compared to children less than six months (Table 5).

**Discussion**

The findings of this study showed that two-week prevalence of diarrhea among under-five children was 23.1% (95% CI: 19.4 - 26.5). This figure was higher than the Ethiopian national prevalence of diarrheal disease as reported by EDHS 2016, which was 13% (12). This finding is also higher than a study conducted in KeffaSheka (13).

This prevalence was in line with other African countries like Egypt (19.5%) and Cameroon (23.8%) (14).

However it was lower when compared with some parts of the country (Ethiopia), that is 36.5% at Jimma town, 33.7% at Jimma zone, and 30.5% at Arbaminch (15).

The odds of having diarrhea was higher among rural children than urban ones and this
finding was in line with the findings in some parts of Ethiopia like Kersa and Debrebirhan town (16).

This could be attributed to the fact that the lack of awareness, lack of access to water and sanitation facilities in the rural areas was more than in the urban areas. The finding of this study showed that children aged from 6 to 23 months were at high risk of developing diarrhea than children younger than six months old. This finding is in agreement with other studies conducted in Arbaminch and Benishangul Gumuz (17).

This might be due to transition from an exclusive breastfeeding to introduction of complementary food which more exposes them to infectious agents. In addition, children at these ages are either crawling or walking and can easily pick dirt or other contaminated objects for playing or eating. The current study revealed that open waste disposal around the house was an independent risk factor for diarrhea. This result was consistent with other studies conducted in Sheko district and Kersa eastern Ethiopia (16).

Open waste disposal is attributed to direct contact with human excreta when the child starts to crawl, and/or easily accessible for vector and rodents, which may carry diarrhea pathogens to water, food and food utensils. In our study, risk of diarrhea was increases with unavailability of latrine and this finding is in agreement with a study conducted in Indonesia (22).

). The simple explanation might be that availability of latrine reduces fecal
contamination in the domestic environment and, in turn, this prevents transmission of disease-causing organisms to human beings.

The finding of our study showed that the use of unprotected water sources was significantly associated with diarrheal disease. This study is consistent with the study conducted in North Gondar (24). This could be attributed to the fact that unprotected water source can get contaminated easily. This study can be generalized to all under-five children in Jamma district however it shares the limitation of cross-sectional study. As a result, this study may have a difficulty to show the temporal relationship between exposure and outcome variable.

Conclusion

In conclusion, the findings of this study showed that the prevalence of childhood diarrheal disease was high. So, childhood diarrheal disease remains a serious public health challenge in the study area. Living in rural areas, lack of sanitation facilities, unprotected source of drinking water, improper waste disposal, and child age were significantly associated with childhood diarrheal disease.

Abbreviations

CSA: Central Statistical Agency, EDHS: Ethiopia Demographic Health Survey, ETB: Ethiopian Birr, GC: Gregorian calendar, SPSS: Statistical Package for Social Studies, WHO: World Health Organization.

Declaration

Ethics Approval and Consent to Participate

This work has been approved by the ethical review committee of University of Gondar, Collage of Medicine and Health Science, Institute of Public Health. Permission was
obtained from Jamma district health Office. Since personal identifiers are not taken only verbal consent to participate was obtained from parents/care givers after full description about the objective and pros and cons of participating was given for both the parents/care givers and children; this is also accepted by the ethical review committee.

Consent to publication
Not applicable

Availability of data and material
Data will be available from the corresponding author upon request

Competing Interests
There is no any competing of interests related with this work

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Authors’ contribution
GY conceived of the study, coordinate data collection. GY, TY, and AG performed statistical analysis and drafted the manuscript. All authors read and approved the final

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Tables

Table 1: Socioeconomic characteristics of the respondents, Jamma district, northeast Ethiopia, 2017.

| Variables                                | Frequency | Percentage (%) |
|------------------------------------------|-----------|----------------|
| Family size (persons per household)      | 306       | 49.8           |
| <5                                       | 308       | 50.2           |
| ≥ 5                                      |           |                |
| Number of under five children            | 533       | 86.8           |
| 1                                        | 81        | 13.2           |
| ≥ 2                                      |           |                |
| Residence                                |           |                |
| Rural                                    | 545       | 88.8           |
| Urban                                    | 69        | 11.2           |
| Relation of the respondent to the child  |           |                |
| Mother                                   | 586       | 95.4           |
| Caregiver                                | 28        | 4.6            |
| Age of the mother/caretaker (in years)   |           |                |
| <25                                      | 165       | 26.9           |
| 25-34                                    | 296       | 48.2           |
| ≥35                                      | 153       | 24.9           |
| Marital status of mother                 |           |                |
| Married                                  | 565       | 92             |
| Single /not married                      | 10        | 1.6            |
| Category                          | Count | Percentage |
|----------------------------------|-------|------------|
| Divorced                         | 29    | 4.7        |
| Widowed                          | 8     | 1.3        |

| Educational level of mother      |       |            |
|----------------------------------|-------|------------|
| Unable to read and write         | 392   | 63.8       |
| Primary                          | 156   | 25.4       |
| Secondary and higher             | 66    | 10.7       |

| Religion                         |       |            |
|----------------------------------|-------|------------|
| Muslim                           | 273   | 44.5       |
| Christian                        | 341   | 55.5       |

| Ethnicity                        |       |            |
|----------------------------------|-------|------------|
| Amhara                           | 608   | 99         |
| Oromo                            | 5     | 0.8        |
| Tigray                           | 1     | 0.2        |

| Occupation of the mother         |       |            |
|----------------------------------|-------|------------|
| House wife                       | 582   | 94.9       |
| Governmental employee            | 22    | 3.5        |
| Private                          | 10    | 1.6        |

| Educational level of father      |       |            |
|----------------------------------|-------|------------|
| Unable to read and write         | 149   | 24.3       |
| Primary                          | 364   | 59.3       |
| Secondary and above              | 101   | 16.4       |

| Occupation of the father         |       |            |
|----------------------------------|-------|------------|
| Farmer                           | 519   | 84.5       |
| Merchant                         | 30    | 4.9        |
| Governmental employee            | 55    | 9          |
| Private                          | 10    | 1.6        |

| Family monthly income            |       |            |
|----------------------------------|-------|------------|
| ≤ 650.00 Ethiopian Birr          | 286   | 46.6       |
| > 650.00 Ethiopian Birr          | 328   | 53.4       |
Table 2: Environmental characteristics of the respondents, Jamma district, Northeast Ethiopia, 2017
| Variables                                      | Frequency | Percentage (%) |
|------------------------------------------------|-----------|----------------|
| Types of roof material of the living house     |           |                |
| Thatched                                       | 41        | 6.7            |
| Corrugated iron sheet                          | 573       | 93.3           |
| Types of floor material of the living house    |           |                |
| Mud/sang/dug                                   | 560       | 91.2           |
| Wood                                           | 8         | 1.3            |
| Cement                                         | 46        | 7.5            |
| Do animals live with family in one house       |           |                |
| Yes                                            | 96        | 15.6           |
| No                                             | 518       | 84.4           |
| Number of rooms in the house                   |           |                |
| 1                                              | 77        | 12.5           |
| 2                                              | 223       | 36.3           |
| >3                                             | 314       | 51.1           |
| Availability of latrine                        |           |                |
| Yes                                            | 441       | 71.8           |
| No                                             | 173       | 28.2           |
| Availability of hand washing facility          |           |                |
| Yes                                            | 259       | 42.2           |
| No                                             | 355       | 57.8           |
| Main source of domestic water                  |           |                |
| Protected                                      | 388       | 63.2           |
| Unprotected                                     | 226       | 36.8           |
| Distance of water source                       |           |                |
| < 30 minutes                                   | 193       | 31.4           |
| ≥ 30 minutes                                   | 421       | 69.6           |
| Refuse disposal                                |           |                |
| Pit/burn                                       | 277       | 45.1           |
| Open dump                                      | 337       | 54.9           |
Table 3: Maternal child health care and health practice, Jamma district, Northeast Ethiopia, 2017

| Variables                                      | Frequency | Percentage (%) |
|------------------------------------------------|-----------|----------------|
| Types of collection container                 |           |                |
| Pot                                            | 30        | 4.9            |
| Jerican                                        | 584       | 95.1           |
| Drinking water storage had cover               |           |                |
| Yes                                            | 607       | 98.9           |
| No                                             | 7         | 1.1            |
| Take water from drinking storage container by  |           |                |
| Pouring                                        | 472       | 76.2           |
| Dipping                                        | 142       | 23.1           |
| Hand washing practice                          |           |                |
| Good                                           | 319       | 52             |
| Poor                                           | 295       | 48             |
| Child feeding methods/material                  |           |                |
| Hand                                           | 295       | 48             |
| Spoon                                          | 193       | 31.4           |
| Cup and spoon                                  | 34        | 5.5            |
| Breast feeding status                          |           |                |
| Exclusive breast feeding                       | 92        | 15             |
| Partial breast feeding                         | 346       | 56.4           |
| Not breast feeding                             | 176       | 28.7           |
Table 4: Demographic, nutritional and health characteristics of the index children in Jamma district, Northeast Ethiopia, 2017
| Variables                                      | Frequency | Percentage (%) |
|-----------------------------------------------|-----------|----------------|
| Age of index child (in months)                |           |                |
| 0-5 months                                    | 52        | 8.5            |
| 6-23 months                                   | 338       | 55             |
| 24-59 months                                  | 224       | 36.5           |
| Child sex                                     |           |                |
| Male                                          | 330       | 53.7           |
| Female                                        | 284       | 46.3           |
| Place child born                              |           |                |
| Health institution                            | 517       | 84.2           |
| Home                                          | 97        | 15.8           |
| Birth order                                   |           |                |
| First                                         | 156       | 25.4           |
| 2-3                                           | 320       | 52.1           |
| Fourth and above                              | 138       | 22.5           |
| History of diarrhea in the past 2 week        |           |                |
| Yes                                           | 142       | 23.1           |
| No                                            | 472       | 76.9           |
| Nutritional status of the child               |           |                |
| Malnourished                                  | 53        | 8.6            |
| Well nourished                                |           |                |
| Receiving Rota oral drop vaccination          |           |                |
| 1 drop                                        | 409       | 66.6           |
| 2 drops                                       | 188       | 30.6           |
| 3 drops                                       | 17        | 2.8            |
### Table 5: Bi-variable and Multivariate analysis of risk factors of diarrhea among children under 5 years of age, Jamma district, Northeast Ethiopia, 2017

| Variables                              | Diarrhea (N = 614) | COR (95% CI) | AOR(95%)CI |
|----------------------------------------|--------------------|--------------|------------|
|                                        | Yes                | No           |            |
| Residence                              |                    |              |            |
| Rural                                  | 116                | 429          | 2.24(1.32-3.8)* | 2.75(1.33-5.66)* |
| Urban                                  | 26                 | 43           | 1          | 1          |
| Educational level of mother            |                    |              |            |
| Unable to read and write               | 49                 | 343          | 2.6(1.4-4.9)* | 1.72(0.77-3.83) |
| Secondary and Higher                   | 75                 | 81           | 0.4(0.21-0.76) | 0.29(0.13-0.66) |
| Types of floor material of the living house |              |              |            |
| Mud/sand/dug                           | 120                | 440          | 3.1(1.66-5.69)* | 2.46(0.96-6.31) |
| Wood                                   | 1                  | 7            | 5.88(0.67-51.7) | 5.45(0.19-154) |
| Cement                                 | 21                 | 25           | 1          | 1          |
| Availability of latrine/toilet facilities |              |              |            |
| Yes                                    | 130                | 311          | 1          | 1          |
| No                                     | 12                 | 161          | 5.6(3.01-10.44)* | 4.80(2.39-9.60)* |
| Availability of hand washing facilities |              |              |            |
| Yes                                    | 94                 | 165          | 1          | 1          |
| No                                     | 48                 | 307          | 3.6(2.45-5.40)* | 2.45(1.53-3.93)* |
| Main source of drinking water          |                    |              |            |
| Protected                              | 117                | 271          | 1          | 1          |
| Unprotected                            | 25                 | 201          | 3.47(2.17-5.55)* | 2.68(1.54-4.68)* |
| Methods of refuse disposal         | 99  | 178 | 1   | 1   |
|-----------------------------------|-----|-----|-----|-----|
| Pit/burn                          | 43  | 294 | 3.8(2.54-5.69)* | 3.86(2.38-6.26)* |
| Open dump                         |     |     |     |     |

| Take water from drinking storage container | 126 | 346 | 1   | 1   |
|--------------------------------------------|-----|-----|-----|-----|
| By pouring                                 | 16  | 126 | 2.9(1.64-5.0)** | 0.40(0.20-0.79) |
| By Dipping                                 |     |     |     |     |

| Age of index child                      | 11  | 41  | 1.8(0.88-3.7) | 1.71(0.98-2.66) |
|-----------------------------------------|-----|-----|---------------|----------------|
| 0-5 months                               | 58  | 280 | 2.33(1.57-3.47)* | 2.46(1.49-4.05)* |
| 6-23 months                              | 73  | 151 | 1             | 1              |
| ≥ 24 months                              |     |     |     |     |

**Supplementary Files**

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