

Research Article

Prevalence and Determinants of Diarrhea among Under-Five Children in Benna Tsemay District, South Omo Zone, Southern Ethiopia: A Community-Based Cross-Sectional Study in Pastoralist and Agropastoralist Context

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Background. Diarrhea is the second leading cause of death among children under-five years globally and accounts for about 1.5 million deaths each year. In low-income countries, children under three years of age experience three episodes of diarrhea on average every year. In Ethiopia, diarrheal disease is one of the common causes of mortality in under-five children. In Benna Tsemay district, pastoralist community lives with lack of clean water, sanitation, and hygiene problems, which increase the risk of childhood diarrhea. **Objective.** To assess the prevalence and determinant of diarrheal disease among under five children in Benna Tsemay District, South Omo Zone, Southern Ethiopia. **Methods.** A community-based cross-sectional study was conducted on a sample of 722 under five children selected randomly from eight pastoralists and two agropastoralist kebels. Data were collected using an interviewer-administered questionnaire. Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 20. Logic regression was performed to identify the association between diarrheal disease and independent variables. Adjusted odds ratio with 95% confidence intervals (CIs) was used to judge the presence of association. **Results.** The two-week period prevalence of childhood diarrheal disease in the study was 23.5% (95% CI: 20.4%–26.6%). Diarrheal illness was associated with nonavailability of latrine (AOR: 2.77, 95% CI: 1.66–4.63), *faeces* seen around the pit hole or floor of latrine (AOR: 2.92, 95% CI: 1.38–6.19), improper kitchen waste disposal (AOR: 2.31, 95% CI: 1.26–4.24), unprotected drinking water source (AOR: 1.81, 95% CI: 1.14–2.88), mother's or caretaker's diarrhea history in the last two weeks (AOR: 6.74, 95% CI: 2.51–18.07), materials used for feeding the child (cup and spoon) (AOR: 0.60, 95% CI: 0.36–0.97), and being unvaccinated for "rotavirus" (AOR: 2.87, 95% CI: 1.86–4.44). **Conclusion.** Nearly one-fourth of children had diarrheal illness in the preceding two weeks. Water, sanitation and hygiene-related factors, child feeding practice, and children's vaccination status for rotavirus were the determinants of the occurrence of diarrhea among under-five children. The health office should conduct sustainable health education programs that emphasize on risk of open defecation, waste disposal mechanisms, and child feeding practices and also should strengthen rotavirus vaccination activities. The district administration and partners' needed to improve water sources.

1. Introduction

Diarrhea can be defined as experiencing loose or watery stool for three or more times during a 24-hour period. It is caused mostly by infection causing pathogens including bacteria, viruses, and parasites [1]. Infectious diarrhea is

acquired by fecal-oral transmission route, by person to person contact, through water or food or directly to the mouth. The absence of a proper water supply, with rubbish and dirty surroundings and an abundance of flies, is the typical situation in which diarrheal diseases are transmitted [2].

Diarrhea is a major public health problem. It is the second leading cause of death among children under-five years globally and accounts for almost one in five child deaths, about 1.5 million each year. Cumulatively, it alone kills more young children than acquired immune deficiency syndrome (AIDS), malaria, and measles [3]. The majority of this death is in children who live in low- and middle- income countries [4].

United Nations Children's Fund's (UNICEF's) 2016 report indicates that diarrheal disease accounts for approximately 8 percent of all deaths among children under the age of five years worldwide. This means that over 1,300 young children die each day, or about 480,000 children in a year, despite the availability of simple effective treatment [5]. In low-income countries, children under three years old experience on average three episodes of diarrhea every year. In each episode, the child loses nutrition that is necessary for growth. As a result, diarrhea becomes a serious cause of malnutrition and the malnourished children are more likely to fall ill from diarrhea [6]. However, in developed countries, relatively few patients die from diarrhea, because the morbidity from diarrheal diseases has remained relatively constant during the past two decades. Studies conducted in central and rural Ethiopia have revealed diarrheal disease to be one of the common causes of under-five mortality, accounting for approximately 8.4% to 27% of all deaths [7].

Intervention is required to prevent diarrhea which includes providing safe drinking water, use of improved sanitations, and hand washing with soap. Diarrhea can also be treated with oral rehydration solution (ORS) or a solution of clean water, sugar, and salt. In addition, a 10–14 days supplemental treatment course of 20 mg zinc tablets shortens diarrhea disease duration and improves outcomes [6].

The magnitude of childhood diarrhea differ from one region to the other. According to the 2016 Ethiopian Demographic and Health Survey (EDHS) report, the two-week period prevalence of diarrhea among under- five children was approximately 12% [8], but a study conducted in northwestern Ethiopia showed the two weeks period prevalence of diarrhea among under-five children in 2017 to be 20%. Similarly, a community-based cross-sectional study conducted in Jabitehnan district, West Gojjam Zone, Amhara Region, Ethiopia, reported a 21.5% two-week period prevalence of diarrhea [9, 10]. But in most remote and pastoralist areas, the prevalence is expected to be higher because of shortage of drinking water, poor sanitation, and low educational and awareness levels. For example, a study in Somali Region, Eastern Ethiopia (a predominantly pastoralist area), has shown the two-week period prevalence of diarrhea among under-five children to be more than two times that of the national prevalence [11].

Benna Tsemaye District is one of a pastoralist districts in the South Omo Zone of Southern Ethiopia. According to the District Health Office 2016/17 report, 28.5% of all under five outpatient department visits in the district were due to diarrheal diseases and diarrheal disease was the first leading cause of morbidity in the district. Having low access to improved drinking water sources and obtaining water from

unprotected water sources such as rivers or ponds put children in the district at a higher risk of diarrheal diseases.

However, there is no study which documented on the prevalence and determinant factors associated with diarrheal disease in Benna Tsemay District. Therefore, the aim of this study was to identify the prevalence and determinants of diarrheal disease among children younger than five years in the district. The information may be used to design locally applicable interventions in accordance with the identified determinants of childhood diarrhea.

2. Materials and Methods

2.1. Study Area. Benna Tsemay District is one of the districts in the South Omo Zone of southern Ethiopia. The capital of the district is Keyafer, which is located 483 kms and 708 kms to south from the regional capital Hawassa and Addis Ababa, respectively, and 42 kms away from Jinka, the capital of South Omo Zone. It is bordered, in the south by Hammer District, in the west by Salamago, in the north by South Aari and Maale Districts, in the northeast by the Segen Zone, and in the south east by the Oromia Region. The Woito River separates it from Segen Zone and Oromia Region. The western part of the district is part of the Mago National Park (Figure 1). The estimated population size in Benna Tsemay District in 2016/17 was 68,774 (that means 9.2% of the total population of South Omo Zone); from these, 34,524 (50.19%) were females. The total number of households in the district is 14,035. Children under five years of age are 10,736 and approximately 58,458 (85%) of the population resides in rural kebeles (the smallest administrative units in Ethiopia [12]).

The district has a total of 32 kebeles of which 28 are pastoralists and the remaining four are agropastoralists. The district currently has 6 health centers and 32 health posts. It has predominantly hot and humid climatic condition with 400–1400 mm³ annual average rainfall and 23°C average monthly temperature. The majority of the population is pastoralist. According the district mine and water office report, in 2016/2017, the main water sources for the majority of the populations were shallow well fitted with hand pump and pool water [13].

2.2. Study Design and Population. A community-based cross-sectional study was conducted from 01 January to 30 February, 2019, among children under five years of age who were living in Benna Tsemay District, southern Ethiopia. The study population comprised of children under five years old found in selected kebeles and selected households.

2.3. Sample Size Determination and Sampling Procedures. The sample size required for determining the prevalence of diarrhea was calculated using a single population proportion formula by considering the prevalence of under-five diarrheal disease as 30.5% [14]. The researchers considered 5% of margin of error, and 95% confidence level. The calculated sample size was 326. Taking a design effect of 2 and by adding 10% for nonresponse, the final calculated sample size was 717. The sample size required to identify the

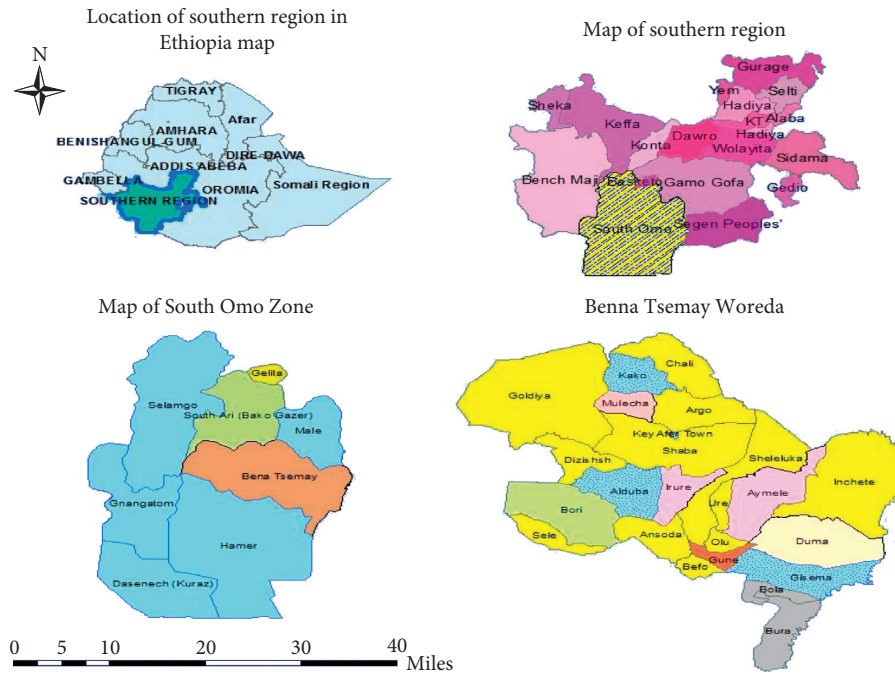


FIGURE 1: Administrative map of Benna Tsemay Woreda, South Omo Zone, Southern Ethiopia, 2019.

determinants of diarrhea was calculated by using Epi info Version 7. By taking the proportion of children who are from households with improved water sources to be 27.35% and the odds ratio of unimproved water source vs improved water sources to be 1.98 based on a study in Gamo Goffa Zone, Arba-minch District [14] and considering a confidence level of 95%, a power of 80%, and an unexposed-to-exposed ratio of 1, the sample size calculated was 722. As the sample size for objective two (722) is larger than the sample size for the first objective (717), we used the maximum sample size of 722 for the study.

Multistage sampling technique was used to select the households. In Benna Tsemay District, there are 28 pastoralist and 4 agropastoralist kebeles. According to the rule of thumb for the feasibility of the study, about 31% of Kebeles were covered by this study. Among them, eight pastoralist and two agropastoralist Kebeles were randomly selected. The kebeles were stratified as pastoralist and agropastoralist kebeles. All of the kebeles in each stratum were listed alphabetically, and then a simple random sampling technique was used to select the specific kebeles for this study. Finally, systematic sampling technique was employed to select households with 4th interval and under-five children in the selected households were included in the study. If the selected household had two or more children less than five years of age, one child was selected randomly.

2.4. Data Collection Tools and Procedures. Data were collected from 01 January to 30 February, 2019, using structured, pretested, and interviewer-administered questionnaire. The questionnaire was prepared based on the EDHS and other literature which is related to diarrhea among under-five children [1, 15–17]. The questionnaire consisted of a total of

59 close-ended questions which were divided into four sections. The first section contained residence of household, number of children under-five and family size; the second section included demographic and economic variables; the third section was about potential predisposing environmental factors, and the fourth section contained information about the index child (including diarrheal morbidity).

The instrument was prepared in English and then translated into Amharic for the data collection. Respondents were mothers of the eligible children, but in the absence of the mother, the next primary caregiver was interviewed. The data were collected by eight data collectors; among these six were grade 10th or grade 12th or university students. Two diploma holder nurses supervised the data collection. The data collectors had experience in data collection in rural communities and were fluent in Amharic. In addition, they can speak Bannigna and Tsemayigna languages (the local languages of the study area). Moreover, two Ethiopian field epidemiology and laboratory training program residents provided overall oversight in the data collection process.

2.5. Data Quality Assurance. Training and discussion on contents of the questionnaire, methods of interview with local language, and important factual data for three days were conducted for all data collectors and supervisors prior to starting the data collection. The questionnaire was pre-tested in sample kebeles that were not included in the main survey. Proper and close supervision of the interviewers was done to ensure accuracy and to help clarify any issues that arise in the data collection process. The investigator checked the filled questionnaires carefully for completeness and any missing responses at the end of the day and feedback was given to the data collectors for correction the following day.

2.6. Data Analysis. Responses were properly coded before being entered into a computer program. Data entry and analysis were performed using SPSS version 20, and the results were summarized using tables. For continuous variables, normality of the distribution was assessed based on histogram with a distribution curve. Multiple logistic regression was fitted using the “enter” method to identify the determinants of diarrhea adjusting the effect of each variable for the confounding effect of other variables in the model. Variables entered into the multivariate model were those having $P \leq 0.25$ in the bivariable regression. The fitness of the model was assessed using Hosmer–Lemeshow statistic. Finally, the outputs of bivariable and multivariable logistic regression were presented, respectively, as crude odds ratio (COR) and adjusted odds ratio (AOR) along with their 95% confidence interval (CI). The AORs with their 95% CIs were used to assess the presence and strength of association between diarrheal morbidity and different determinants.

3. Ethical Considerations

Ethical clearance was obtained from the Institutional Review Board at the College of Medicine and Health Sciences of Hawassa University. Permission letters were obtained from South Omo Zone Health Department and Benna Tsemay District Health Office. Further, verbal informed consent was obtained from each respondent after clearly explaining the purpose of the study and data confidentiality. The verbal consent was preferred because the majority of the respondents were illiterate. Confidentiality of the information acquired was assured by using only codes and by avoiding use of any personal identifiers. During the interview, mothers or caretakers unable to complete the interview were allowed to withdraw from the interview. For children having active diarrhea during the study, the mothers/care takers were advised to visit the nearby health facility to get treatment for the children with diarrhea.

4. Results

4.1. Demographic and Socioeconomic Characteristics of the Households. A total of 722 under-five children with their mothers/caretakers were planned to be included in the study, and all took part in the study resulting in a response rate of 100%. Among the total participants, 521 (72.2%) were rural dwellers and 709 (98.2%) of the interviews were conducted with biological mothers and the rest with caretakers of the children. More than two-thirds (68.6%) of the households had a family size of greater than four people.

The mean (\pm standard deviation (SD)) age of the mothers or caretakers of the children included in the study was 30.5 (± 6.97) years and ranged from 18 to 48 years. Majority (96.7%) of the mothers or caretakers were married. Almost half of the mothers (49.4%) were traditional believers by their religion and the majority (71.7%) of the mothers or caretakers did not attend any formal education and 310 (42.9%) were farmers by occupation (Table 1).

4.2. Environmental Characteristics of the Households. Of the total households from which the children were selected, the majority (87.4%) had dwellings with mud floor and 570 (78.9%) had no roof. One-hundred eighty seven (25.9%) households shared their living rooms with animals and 479 (65.7%) households had only one room. Four-hundred thirty eight (60.7%) of the households had latrine facility, of which 428 (97.7%) were traditional pit type of latrine, 414 (94.5%) had privately owned latrine and 380 (86.8%) were clean, i.e., had no faeces seen around floor of the latrine.

In 91.4% of the 438 households with latrine facility, the pit holes did not have a cover. In 161 (36.8%) of the addressed households, flies were seen around house or in toilet area. From the households having latrine, 76 (17.4%) had hand washing facility at the toilet, of which only half (51.3%, $n = 39$) had water during the data collection and only 17 (22.4%) had soap or ash at the handwashing facility.

Four-hundred and thirty eight (60.7%) of the households used drinking water from protected water sources. The cost of water consumption per month indicated that the majority (86.3%) of the households were spending less than \$0.5 per month and 288 (39.9%) took more than 30-minute walk to fetch water. Further, two-hundred thirty four (32.4%) of the households use water storage containers, the majority (74.4%) of which are locally available Jerry cans. From the total households, 129 (17.9%) treat their drinking water at home, of whom 61 (47.7%) used chemicals to treat the water (Table 2).

4.3. Characteristics of the Index Children. Of the 722 index children, 339 (47%) were 24 months old and above and 386 (53.5%) were females. The mean (\pm SD) age of the index children was 21.42 (± 13.78) months. Regarding the place of delivery, almost two-third (66.9%) of the children were born in health institutions. In terms of their birth order, 353 (48.9%) of the children had an order of four and above.

During the data collection period, majority (96.7%) of the mothers or caregivers responded that they did not have history of diarrhea in the last two weeks. Out of the total 722 mothers or caretakers, 101 (14.2%) mothers were exclusively breastfeeding their children at the time of the study. Out of those mothers who initiated additional food for their children, 292 (47.7%) mothers started supplementary feeding for their children before the child reached 6 months.

Regarding type of food or fluid prepared for their children, 41.1% of the mothers/caregivers were using cow milk and 280 (45.1%) used cup and spoon to feed their children. Besides, about three-quarters (74.6%) of the mothers/caregivers responded that they prepare food for their children separately from the food for other family members. Concerning the vaccination status of children, 521 (72.2%) of the children were vaccinated for measles and 466 (64.5%) were vaccinated for rotavirus.

With regard to the prevalence of diarrheal disease among under-five children, 170 (23.5%, 95% CI: 20.4%–26.6%) of the children had a diarrheal disease in the two-week period preceding the study (Table 3).

TABLE 1: Demographic and socioeconomic characteristics of the households in Benna Tsemay District, South Omo Zone, Southern Ethiopia, 01 January to 30 February, 2019.

Variables (<i>n</i> = 722)	Response category	Frequency	Percentage (%)
Residence	Urban	201	27.8
	Rural	521	72.2
Family size	Four and less	227	31.4
	More than four	495	68.6
Number of under-five children in the household	One	314	43.5
	Two and above	408	56.6
Relation of respondents to child	Mother	709	98.2
	Care taker	13	1.8
Age of mothers or caretaker	18–24	155	21.5
	25–34	342	47.4
	35 and more	225	31.2
Marital status	Married	698	96.7
	Divorced	10	1.4
	Others	14	1.9
Religion	Traditional	357	49.4
	Protestant	214	29.6
	Orthodox	135	18.7
	Others**	16	2.2
Education of mothers or caregivers	Secondary and above	98	13.6
	Primary	106	14.7
	Illiterate	518	71.7
Occupation of mothers or caregivers	Housewife	235	32.5
	Farmer	310	42.9
	Government employee	66	9.1
	Other***	111	15.4
Age of fathers, <i>n</i> = 711	18–24	49	6.9
	25–34	326	45.9
	35 and more	336	47.2
Education of fathers	Secondary and above	125	17.6
	Primary	117	16.5
	Illiterate	469	66
Occupation of fathers	Farmer	246	34.6
	Livestock	310	43.6
	Employee	94	13.2
	Other****	61	8.6
Average income	<17 USD	311	43.1
	17–33 USD	134	18.6
	>33 USD	277	38.4
Households own a television	Yes	82	11.4
	No	640	88.6
Households have kitchen	Yes	315	43.6
	No	407	56.4
Households send all the children of school age to school	Yes	378	52.4
	No	344	47.6

*Single, widowed, and separated; **Muslim and apostolic; ***daily laborer and jobless; USD, United States Dollar.

4.4. *Determinants of Childhood Diarrhea.* Among the addressed demographic, socioeconomic, and environmental factors, some showed association with childhood diarrhea. In crude analyses, rural residence of the household [COR: 1.65, 95% CI: (1.09–2.50)], family size of more than four in the household [COR: 1.57, 95% CI (1.06–2.32)], two or more under-five children in the household [COR: 1.27, 95% CI (1.20–2.47)], illiteracy of the mother/caregiver [COR: 2.39, 95% CI (1.29–4.43)], availability of television [COR: 3.13,

95% CI (1.48–6.64)] and kitchen [COR: 1.62, 95% CI (1.13–2.32)], availability of latrine facility [COR: 2.35, 95% CI (1.66–3.34)], having faeces around the pit-hole or floor of latrine [COR: 4.45, 95% CI (2.44–8.41)], improper kitchen waste disposal [COR: 2.48, 95% CI (1.55–3.97)], unprotected drinking water source [COR: 2.07, 95% CI (1.46–2.94)], and time of more than 30 minutes spent to fetch water [COR: 1.47, 95% CI (1.03–2.08)] were found significantly associated with childhood diarrhea. Further, from child health and

TABLE 2: Environmental characteristics of the households in Benna Tsemay District, South Omo Zone, Southern Ethiopia, 01 January to 30 February, 2019.

Variables (<i>n</i> = 722)	Response category	Frequency	Percentage (%)
Housing floor material	Mud	631	87.4
	Wood	67	9.3
	Cement	14	1.9
	Other*	10	1.4
Animals live in same house	Yes	187	25.9
	No	535	74.1
Number of rooms	One room	474	65.7
	Two rooms	93	12.9
	Three and above	155	21.5
Latrine availability	Yes	438	60.7
	No	284	39.3
Type of latrine (<i>n</i> = 438)	Improved	10	2.3
	Traditional pit latrine	428	97.7
Latrine ownership (<i>n</i> = 438)	Privately owned	414	94.5
	Shared	24	5.5
Faeces seen around the pit-hole or floor of latrine (<i>n</i> = 438)	Yes	58	13.2
	No	380	86.8
Latrine had pit-hole cover (<i>n</i> = 438)	Yes	36	8.2
	No	402	91.4
Faeces seen around house or in compound (<i>n</i> = 438)	Yes	69	15.8
	No	369	84.2
Hand wash facility	Yes	76	17.4
	No	362	82.6
Hand wash facility had water then (<i>n</i> = 76)	Yes	39	51.3
	No	37	48.7
Hand washing facility contained soap or ash (<i>n</i> = 76)	Yes	17	22.4
	No	59	77.6
Place of disposal of child faeces	Open field	341	47.2
	Pit or burning	69	9.6
	Latrine	252	34.9
	Others**	60	8.3
Waste disposal	Proper disposal	310	42.9
	Improper disposal	412	57.1
Status of drinking water source	Protected source	438	60.7
	Unprotected source	284	39.3
Time spent to fetch water	Thirty minutes and less	434	60.1
	More than thirty minutes	288	39.9
Collected or storage water	Yes	234	32.4
	No	488	67.6
Type of water collection and storage container (<i>n</i> = 234)	Pot	7	3
	Plastic container	45	19.2
	Iron container	8	3.4
	Jerry cans	174	74.4
Place water containers were kept	On a table (raised place)	46	19.7
	On the ground	188	80.3
Cover for water container	Yes	224	95.7
	No	10	4.3
Treat water at home	Yes	129	17.9
	No	593	82.1
Water treatment method	Boiling	30	23.4
	Filtering	38	28.9
	Chemical	61	47.7

*Plastic sheet and stone; **garden, locally selected place.

TABLE 3: Demographic and health characteristics of the indexed children in Benna Tsemay District, South Omo Zone, Southern Ethiopia, 01 January to 30 February, 2019.

Variables	Response category	Frequency	Percentage (%)
Age of child (months)	0–5	83	11.5
	6–11	108	15
	12–23	192	26.6
	≥24–59	339	47
Child sex	Male	336	46.5
	Female	386	53.5
Place of delivery	Home	239	33.1
	Health facility	483	66.9
Index child birth order	First	98	13.6
	Second	127	17.6
	Third and above	497	68.8
Mother or caretaker have diarrhea history in the last two weeks	Yes	24	3.3
	No	698	96.7
Current breast feeding status	Exclusive breast feeding	101	14
	Partial breastfeeding	415	57.5
	Not breastfeeding	193	26.7
Time initiated for complementary feeding (months) (<i>n</i> = 621)	Before 6 months	293	47.2
	At 6 months	296	47.7
	After 6 months	32	5.2
the child mostly takes food or fluid?	Cow's milk	255	41.1
	Powder milk	19	3.1
	Gruel	247	39.8
	Family food	87	14
	Others*	13	2.1
Method of feeding	Hand	225	36.2
	Cup and spoon	280	45.1
	Bottle	44	7.1
	Others**	72	11.6
Separately prepare child food	Yes	463	74.6
	No	158	25.4
Measles	Yes	521	72.2
	No	201	27.8
Rotavirus vaccine	Yes	466	64.5
	No	256	35.5
Have diarrhea in the last two weeks	Yes	170	23.5
	No	552	76.5

*Porridge and locally available food; **small dish and locally available material.

demographic determinants, the mother's or caretaker's history of diarrhea in the last two weeks [COR: 7.06, 95% CI (2.96–16.8)], initiation of complementary feeding at 6 months [COR: 0.43, 95% CI (0.29–0.64)], use of bottle to feed the child [COR: 0.50, 95% CI (0.28–0.91)], and rotavirus vaccination status [COR: 2.53, 95% CI (1.78–3.60)] were significantly associated with childhood diarrhea.

However, among all above determinants, after adjustment for other variables, seven variables were found significantly associated with under-five diarrhea. These included nonavailability of latrine, faeces seen around the pit hole or floor of latrine, improper kitchen waste disposal, unprotected drinking water source, mother's/caretaker's diarrhea history in the last two weeks, materials used for feeding the child (cup or spoon), and being unvaccinated for "rotavirus". Specifically, children from household with no latrine availability had 2.77 times higher odds of diarrhea relative to

children in household with latrine facility (AOR: 2.77, 95% CI: 1.66–4.63). Faeces around the pit-hole or floor of latrine increased the odds of childhood diarrhea by about three-fold (AOR: 2.92, 95% CI: 1.38–6.19). Children from households with improper kitchen waste disposal had 2.31 times higher odds of diarrhea compared with children from households with proper kitchen waste disposal (AOR: 2.31, 95% CI: 1.26–4.24), whereas children whose households consumed water from unprotected sources had nearly twice higher odds to develop diarrhea compared with children whose households consumed water from protected sources (AOR: 1.81, 95% CI: 1.14–2.88). The odds of diarrhea were nearly seven-fold in children from households with maternal/caretaker's diarrhea history in the last two weeks compared with children from households where the mothers/caretakers had no diarrhea history in the last two weeks (AOR: 6.74, 95% CI: 2.51–18.07). Further, children fed with cup and spoon had 40% lower odds of diarrhea than

TABLE 4: Demographic, socioeconomic, and child demographic health determinant of under-five diarrhea in Benna Tsemay District, South Omo Zone, Southern Ethiopia, 01 January to 30 February, 2019.

Variables	Diarrhea, <i>n</i> (%)	No diarrhea, <i>n</i> (%)	COR (95% C.I)	AOR (95% C.I)
<i>Residence</i>				
Urban	35 (17.4)	166 (82.6)	1	1
Rural	135 (25.9)	366 (74.1)	1.65 (1.09–2.50)*	1.10 (0.60–2.00)
<i>Family size</i>				
Four and less	42 (19.8)	188 (80.2)	1	1
More than four	128 (27.9)	364 (72.1)	1.57 (1.06–2.32)*	1.28 (0.79–2.09)
<i>Number of <5 children in the household</i>				
One	57 (18.2)	257 (81.8)	1	1
Two and above	113 (27.7)	295 (72.3)	1.27 (1.20–2.47)*	1.23 (0.77–1.96)
<i>Education of mothers or caregivers</i>				
Secondary and above	13 (13.3)	85 (86.7)	1	1
Primary	18 (17)	88 (83)	1.33 (0.61–2.89)	0.66 (0.25–1.70)
Illiterate	139 (26.8)	379 (73.2)	2.39 (1.29–4.43)*	0.75 (0.33–1.69)
<i>Availability of television</i>				
Yes	8 (9.8)	74 (90.2)	1	1
No	162 (25.3)	478 (74.7)	3.13 (1.48–6.64)*	0.83 (0.29–2.42)
<i>Availability kitchen</i>				
Yes	59 (18.7)	256 (81.2)	1	1
No	111 (27.3)	296 (72.7)	1.62 (1.13–2.32)*	0.77 (0.46–1.29)
<i>Latrine availability</i>				
Yes	76 (17.4)	362 (82.6)	1	1
No	94 (33.1)	190 (66.9)	2.35 (1.66–3.34)*	2.77 (1.66–4.63)*
<i>Faeces seen around the pit-hole or floor of latrine</i>				
No	52 (13.7)	328 (86.3)	1	1
Yes	24 (41.4)	34 (58.6)	4.45 (2.45–8.10)*	2.92 (1.38–6.19)*
No latrine**	94 (33.1)	190 (66.9)	3.12 (2.13–4.58)*	-
<i>Kitchen waste disposal</i>				
Proper disposal	24 (13)	160 (87.4)	1	1
Improper disposal	146 (27.1)	392 (72.9)	2.48 (1.55–3.97)*	2.31 (1.26–4.24)*
<i>Drinking water source</i>				
Protected source	80 (18.3)	358 (81.7)	1	1
Unprotected source	90 (31.7)	194 (68.3)	2.07 (1.46–2.94)*	1.81 (1.14–2.88)*
<i>Time spent to fetch water</i>				
30 minute and less	90 (20.7)	344 (79.3)	1	1
More than 30 minute	80 (27.8)	208 (72.2)	1.47 (1.03–2.08)*	1.21 (0.77–1.90)
<i>Mother or caretaker having diarrhea history in the last 2 weeks</i>				
Yes	16 (66.7)	8 (33.3)	1	1
No	154 (22.1)	554 (77.9)	7.07 (2.97–16.82)*	6.74 (2.51–18.07)*
<i>Time initiated for complementary feeding</i>				
Before 6 months	93 (31.7)	200 (68.3)	1	1
On 6 months	50 (16.9)	246 (83.1)	0.43 (0.29–0.64)*	0.72 (0.45–1.16)
After 6 months	7 (21.9)	25 (78.1)	0.60 (0.25–1.44)	0.54 (0.21–1.40)
<i>Materials for feeding the child</i>				
Hand	65 (28.9)	160 (71.1)	1	1
Cup and spoon	51 (18.2)	229 (81.8)	0.92 (0.51–1.64)	0.60 (0.36–0.97)*
Bottle	12 (27.3)	32 (72.7)	0.50 (0.28–0.91)*	0.98 (0.42–2.29)
Others	22 (30.6)	50 (69.4)	0.85 (0.37–1.95)	0.98 (0.48–2.01)
<i>Rotavirus vaccine</i>				
Yes	81 (17.4)	385 (82.6)	1	1
No	89 (34.8)	164 (65.2)	2.53 (1.78–3.60)*	2.87 (1.86–4.44)*

Note: AOR, adjusted odds ratio; COR, crude odds ratio. *Statistically significant at an alpha value of 0.05. **Due to redundancy with the variable “latrine availability,” AOR for the third category of the variable “Faeces seen around the pit-hole or floor of latrine” cannot be computed. Hosmer and Lemeshow goodness-of-fit test: chi-squared=8.54; degree of freedom = 8; *P* value = 0.382.

children fed by hand (AOR: 0.60, 95% CI: 0.36–0.97), while the odds of having diarrhea was around three times higher among

children unvaccinated for rotavirus than those vaccinated for rotavirus (AOR: 2.87, 95% CI: 1.86–4.44) (Table 4).

5. Discussion

The present study investigated the prevalence and socio-economic and environmental risk factors of diarrheal disease among children under-five years in southern Ethiopia. The two-week period prevalence of childhood diarrheal disease in this study was 23.5% with 95% CI: (20.4, 26.6). Factors that were statistically significant predictors of childhood diarrheal disease were nonavailability of latrine, faeces seen around the pit hole or floor of latrine, improper kitchen waste disposal, unprotected drinking water source, mother's or caretaker's diarrheal history in the last two weeks, materials used for feeding the child (cup or spoon), and being unvaccinated for rotavirus.

The prevalence of diarrheal disease in under-five children in this study was in line with a study conducted in Kersa District, Eastern Ethiopia (22.5%), Jabithennan District, Northwest Ethiopia (21.5%), Yaya Gulele district (22.4%), Hadaleala District, Afar Region (26.1%) [10, 18–20] and also other studies conducted in Cameroon (23.8%), Guinea-Bissau (22.3%), and India-Kashmir (25.2%) [21–23] and relatively low compared with studies performed in Enderta Woreda, Northern Ethiopia (35.6%), and Arba Minch District, Southern Ethiopia (30.5%) [14, 24]. But this two-week period prevalence of diarrheal disease is high compared with the study reported nationally from EDHS in 2016, which is 12% [8] and studies conducted in Jimma Zone, South West Ethiopia (14.9%), Laelay Michew District of Tigray Region, North Ethiopia (17.7%), Wolitta Zone, Southern Ethiopia (11%), and Farta District, North West Ethiopia (16.7%) [16, 25–27]. The possible justification for this difference might be geographical, sociocultural, and economic differences. Especially, the higher prevalence of diarrheal disease in this study relative to several previous studies [16, 25–27] could be attributable to the low socio-economic development in the pastoralist community addressed by the present study compared with other parts of the country and use of unprotected water source such as rivers, streams, and pools, which are prone to contamination.

The excreta of all infected people are dangerous. It is impossible to know who is infected and so it is important to dispose safely all excreta in latrine. In this study, children from households without latrine facilities had more than twice higher odds to develop diarrheal disease compared with children from households with latrine facilities. This finding was similar with that of the other studies [4, 11, 20, 28].

In this study, faeces seen around the pit-hole or floor of latrine was another factor associated with under-five diarrheal disease. Children from households where there were faeces seen around the pit-hole or floor of latrine had almost three times higher odds of diarrheal disease than those children from the households where faeces were not observed around the pit-hole or floor of latrine. This finding is consistent with that of the other studies [7, 21]. This might be due to the fact that during latrine visit, faeces around the pit-hole or floor of latrines create opportunity for direct contact with excreta. Furthermore, poorly managed human excreta may pollute drinking water sources and different food items and creates favorable conditions for vector breeding which could facilitate a wide spread of diarrheal disease.

Children from households who use unprotected water sources had higher odds to experience diarrheal disease compared with children from households who use protected water sources, which is similar with that of studies performed in Jijjiga District, Somali Region, Eastern Ethiopia [11] and in Medebay Zana District, Northwest Tigray, Ethiopia, Bahir Dar Zuria District, and Hadaleala District [9, 20, 28]. This could be because unprotected water sources are highly likely to be polluted and to predispose children for diarrheal disease.

Children from the households with mothers/caretakers who had diarrheal history in the last two weeks had more probability to have diarrheal disease compared with the children from households with mother or caretakers who had no diarrheal history in the last two weeks. The findings of this study were almost similar with the findings of studies conducted in Mecha District, West Gojam, Ethiopia; Jijjiga District, Somali Region; and Zana District, Northwest Tigray [9, 11, 28, 29]. Mothers in the study area often had close and direct contact with their children as they assume the primary responsibility for taking care of their children. This could lead to direct transmission of diarrheal disease from mothers to children.

This study also revealed that a rotavirus vaccination status was significantly associated with childhood diarrheal disease. Children who were not vaccinated for rotavirus had almost three times more odds to develop diarrheal disease than children vaccinated for rotavirus. It agreed with the finding reported from Farta Wereda, Northwest Ethiopia [28]. Rotavirus is known to cause more than a fifth of diarrheal hospitalizations among children globally [30]. This implies that rotavirus vaccination could be one of the ways to prevent diarrheal disease.

Children from household who practice improper kitchen waste disposal had 2.3 higher odds of diarrheal disease compared with children from household with proper kitchen waste disposal. This finding was consistent with findings from elsewhere such as Sheko district rural community, Southwest Ethiopia [31], Eastern Ethiopia [18], Jijjiga District, Somali Region, Eastern Ethiopia [11], Dale District, Sidama zone, Southern Ethiopia [32], and Jamma district, South Wollo zone, Northeast Ethiopia [33]. This could be due to the fact that improper waste disposal creates easy access for vectors and rodents which will facilitate the transmission of diarrheal disease by contaminating foods, drinks, and household utensils. Besides, small children may come in direct contact with the waste and hence will be predisposed to diarrheal disease.

In the present study, children whose mothers/caretakers practice cup and spoon feeding had 40% lesser odds to develop diarrheal disease compared with children whose mothers practice feeding by hand. This evidence corroborated results from Northwest Ethiopia [10], and Southern Ethiopia [34]. The probable reason might be that cup and spoon feeding prevents contamination and such materials can be easily cleaned.

The present study has limitations. The risk of childhood diarrheal disease varies by season. Hence, it was difficult to detect seasonal variations in diarrheal morbidity. Besides, since this study was done in the dry season, it might underestimate the magnitude of diarrheal disease. Recall bias of diarrheal episodes and vaccination status of the children is also possible. Consequently, while bias in reporting diarrheal history could

underestimate or overestimate the magnitude of diarrhea, bias in reporting vaccination status could also bias the association between diarrhea and vaccinations status.

6. Conclusions

In this study, nearly one-fourth of children had diarrheal illness in the preceding two weeks. Nonavailability of latrine, faeces seen around the pit-hole or floor of latrine, improper kitchen waste disposal, unprotected drinking water source, mothers' or caretakers' diarrhea history in the last two weeks, materials used for feeding the child (cup and spoon), and being unvaccinated for "rotavirus" were statistically significant predictors of diarrhea among under-five children. The health office is advised to conduct sustainable health education programs that emphasize the risk of open defecation, waste disposal mechanisms, and child feeding practices and also it needs to strengthen "rotavirus" vaccination activities. The district administration and partners' shall work towards on strengthening environmental health packages for improving drinking water sources and sanitation to tackle childhood diarrhea.

Data Availability

The original data used to support the findings of this study are available in the hand of authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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