Diarrheal Morbidity and Associated Factors among Under-Five Children in Southwest Ethiopia. Institution based cross-sectional study

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Abstract

Background: In opposite to progressing to achieve target 3.2 of Sustainable Development Goals, which is ending preventable deaths of neonates and under-five years child by 2030, diarrheal disease continued to be the major cause of child mortality in developing countries including Ethiopia. Thus, this study aimed to assess the prevalence of diarrheal morbidity and associated factors among under-five children in southwest Ethiopia.

Methodology: An institution-based cross sectional study was conducted among 2233 under-five children at three randomly selected public hospitals of southwest Ethiopia from March 1 to November 21, 2021. Data were collected from mothers/guardians of the index children selected by systematic random sampling using structured interviewer administered questionnaire. Data entered by Epi_data v.4.2 were analyzed by multivariable logistic regression. P-value <0.05 and 95% confidence-interval (CI) was used to ascertain statistical significance. Results were presented by tables and text.

Result: This study had a response rate of 90.9%. The two-week prevalence of diarrhea among the under-five children was 701(34.53%). The factors associated with it were being female (AOR 0.26; 95%CI=.172-.4), age 12-23 months (AOR 4.37; 95%CI=2.32-8.24), mothers or guardian with no formal education (AOR 3.55; 95%CI=1.97-6.4), being urban resident (AOR 0.48; 95%CI=0.28-0.84), being 1st born *(*AOR .08; 95%CI=.03-.26), frequent hand washing (AOR .58; 95%CI=.26-.66), washing child utensils by cool-water & soap (AOR 2.8; 95%CI=2.12-3.57), unprotected water (AOR 3.6; 95%CI=2.13-6.13), having latrine (AOR .03; 95%CI=.02-.05), replacing water in storage daily (AOR .02; 95%CI=.004-.05), and child-self feeding (AOR 2.4; 95%CI=1.57-3.74).

Conclusion: The prevalence of diarrheal morbidity among under-five children in southwest Ethiopia is unacceptably high. Accordingly, to reduce the morbidity, it is urgent that the parents, health extension workers, the zonal health departments, and all concerned bodies should struggle their best to strengthen the practices of diarrhea preventive methods and to avoid the risk factors.

Background

According to World Health Organization, “Diarrhea is the passage of unusually loose or watery stools at least three times in a 24 hour period” [1]. The consistency of the stool is an important diagnostic criteria rather than the frequency of passing stool [1]. In the case of breastfeeding child, passage of loose stool is common. But the mothers differentiates it from diarrhea. Diarrhea is the major cause of morbidity, mortality, and malnutrition in under developed countries [1, 2].

Globally, 1.87 million deaths of under-five children occurred within a year mostly in developing countries [1, 3]. Within these under-five children deaths, eight-tenths were among children below two years old. Also averagecally, children under-three years of age in developing countries experienced three episodes of diarrhea annually [1]. Daily > 5000 children die due to diarrheal morbidies making diarrheal to hold nearly

one-fifth (18%) share of all causes for under-five children deaths [3, 4]. Most diarrheal deaths occur due to dehydration, dysentery, and persistant diarrhea with malnutrition [1].

Diarrhea has multi-causative-agents including virus, bacteria, and protozoa where the common once are rotavirus (the leading), escherichia coli, vibrio cholerae, shigella, entamoeba histolytica, and giardia lamblia [5–8]. Its' most common risk factors are lack of safe drinking water & using untreated pathogenic water either for drinking or food preparation, poor sewage treatment, and lack of basic sanitation facilities [9–11].

Due to its high prevalence among low income countries, childhood diarrhea is known as a disease of poverty as it also primarly associated with under-nutrition, lack of clean drinking water, and open defication [12, 13]. Although it is expected to be improved, there is continues lack of safe drinking water, and sanitation facility in developing countries making diarrhea the principal cause of death among under-five children [14].

In India, 9% of children less than five years old experienced diarrheal morbidity while being rural resident, and open defecation practice were associated with higher odds of diarrheal episodes [15]. A study done in sub-Saharan Africa countries revealed that the overall prevalence of diarrheal morbidity among under-five children was 15.3% where maternal education up to secondary level, and having low to middle house hold income were associated with increased prevalence [16]. In Namibia, diarrheal disease among under-five children is a major public health concern where its' prevalence was 17% with 5% death risk [17]. Also in Kenya, a country at south border of Ethiopia, the prevalence of diarrheal morbidity among under-five children was 18.7% while child sex, and family size had positive association [18]. As per meta-analysis done on prevalence of diarrheal morbidity among under-five children in Ethiopia, Kenya, and Somalia; the average prevalence was 27% ranging from 11–54%. Also there is risk of extensive escalation up to 207% in the three countries [19].

In northern part of Ethiopia, the prevalence of diarrheal disease among under-five children was 14.5% [20, 21]. In Worabe town, southern Ethiopia, the prevalence of diarrheal morbidity among under-five children was 30.9% while age of the child, child feeding status, hand washing during preparing food for child, and solid waste disposal practice were factors associated with it [22]. The prevalence of diarrhea in Debre Birhan town, central Ethiopia, was 16.8% [23], in Horo Guduru, western Ethiopia, was 24% [24], in Farta district, north central Ethiopia, was 29.9% [25], and at national level was 10.2% [26].

In contrast to target 3.2 of Sustainable Development Goals (SDG, 2030) which is ending preventable deaths of under 5 children, and achieving ≤ 12 neonatal and ≤ 25 under-five child mortality for all countries [27], in Ethiopia, there were 30 neonatal and 55 under-five child mortality per 1,000 live births recently [28]. Also, the coverage of monovalent human rotavirus vaccine that prevents acute diarrheal disease (major cause of diarrheal death) was only 60.5% in rural part (85%) of the country [28]. Nutritionally, 37%, 21%, and 7% of under-five children in Ethiopia were stunted, underweight, and wasted respectively for which diarrhea can be contributing factor. In addition, only 59% of under six month children gained exclusive breast feading escalating the risk of diarrheal morbidity [28].

Overall, even though there is lack of conclusive study published in southwest part of Ethiopia, the prevalence of diarrheal morbidity in different parts of the country varies from each other [20–26]. Also, the factors associated with diarrheal morbidity in different reviewed literatures were mostly not in line with each other [15–26, 29]. But for developing effective strategy for prevention and control of diarrheal morbidity, there is a need for conclusive study done in the particular area as different climatic, seasonal, and environmental factors play great role in diarrheal disease occurance and spread. Thus, this study aimed to assess the prevalence of diarrheal morbidity and associated factors among under-five children in southwest Ethiopia. Hence, the result of this study contributes new evidence on the topic and can serve any concerned bodies to take necessary measurement so as to reduce the prevalence of diarrheal morbidity in southwest part of Ethiopia.

Methods

The Aim, Area, Design, and Period of the study

The aim of this study was to assess the prevalence of diarrheal morbidity and associated factors among under-five children in southwest Ethiopia. It was done in three randomly selected public general hospitals in southwest part of Ethiopia. Namely, the three hospitals are Tercha Hospital, Metu Karl Hospital, and Shenan Gibe Hospital. These hospitals are found in different zones. Tercha hospital is located in Tercha town, Dawro zone, South Nation Nationalities and Peoples Region, at a distance of 422 kilometers from Addis Ababa the capital city of the country to south west direction. Metu Karl hospital is located in Mettu town, Illu Aba Bora zone of Oromia region, 542 kilometers far away from Addis Ababa to southwest direction. Shenen Gibe hospital is found in Jimma town, Jimma zone, Oromia region, at 352 kilometers distance from Addis Ababa. According to the statistics taken from the three hospitals, each of them provides care for more than 5,000 under-five children annually. An institution based cross-sectional study design was taken place from March 1 to November 21/2021.

Source population

The source population of this study was all under-five children brought to the three randomly selected hospitals and lived in the southwest part of the country for at least six months prior to the data collection time.

Study population

The study population was all randomly selected under-five children brought to the three randomily selected hospitals and lived in the southwest part of the country for at least six months prior to data collection time.

Inclusion and Exclusion Criteria

All under-five children brought to the three randomly selected hospitals who had their mother or guardian with them was included. But the under-five children whose mother or guardian can’t communicate

verbally were excluded from the study.

Sample Size Determination

The sample size estimation was calculated using the following formula:

$n = \frac{z^2 * p * q}{d^2} * DEFF$+10 % (non-respons rate)

where, 'n' is the required sample size; '$Z_{a/2}$' is a critical value at 95% confidence level on normal distribution curve which is 1.96; 'd' is margin of error (2%); P is expected prevalence of diarrhea morbidity among under-five children taken as 12% from study done in the country,[30] and '$DEFF$' is the design effect, is used as a correction factor that is used to adjust the required sample size since we used stage sampling method. The required sample size, assuming a simple random sample (SRS), should be calculated, and then multiplied by the$DEFF$. The default value of $DEFF$should be set at 2.0 unless there is supporting empirical data from previous or related surveys that suggest a different value.

Hence, $n = \frac{1.96^2 * 0.12 * 0.88}{0.02^2} * 2 + 203$ ~2233

Sampling Technique

The study was employed a two-stage sampling procedure. At the first stage, three hospitals were selected from thirteen hospitals found in southwest part of the country by using a lottery method. In the second stage, under-five children visiting the three selected hospital where selected randomly by using a systematic random sampling method. The interval by which the study participants selected were determined based on the trend of client flow to the three hospitals within past eight months so as to be in line with the data collection period of the current study that took eight months duration. Thus, the sampling interval was different for the three hospitals.

Data collection instrument and Data collection method

The data was collected by face-to-face interview using a structured questionnaire developed after reviewing relevant litratures [15–26, 30]. The data collection tools had three parts. Part one was about socio-demographic variables; part two was about health, nutritional status, and sanitation related variables; and part three was about environment and related variables. The questionnaire was first prepared in English and then translated into the local languages (Afan Oromo, and Amharic), and again back translated to English by language experts to ensure its consistency. Twelve data collectors (BSc. nurses) and three supervisors (MSc. nurses) were employed from local residents of the respective zones who spoke the local languages. One day training was given for data collectors and supervisors on objective of the study, contents of the questionnaire, and how to approach each study participants. The mothers/guardians of the under-five child brought to pediatric outpatient department of the three hospitals were asked if the child had diarrheal episode within past two weeks. Filled questionnaires were checked for completeness and coded on daily bases by the supervisors.

Data quality control

To ensure quality of data, training was given for the data collectors and supervisors; at the end of each data collection day, supervisors checked the completeness of filled questionnaires and coded it. After data collection, data entry was done by Epi-data version 4.2 to minimize encountering error. And SPSS version 23 was used for data analysis.

Variables of the study

Dependent Variable

The dependent variable of this study is the status of children aged less than five years regarding having diarrhea in the two weeks prior to the survey. So, the dependent variable of the i^{th}children Y_i is measured as a dichotomous variable with possible values.

$$Y_i = \begin{cases} 1, if the i^{\text{th}} childrenhaddiarrhea \\ 0, if the i^{\text{th}} childrenhadnotdiarrhea \end{cases}$$

Independent Variables

The independent variables were sociodemographic characteristics (child's age, sex of child, mothers'/guardians' educational level, and occupation, child's place of birth, birth order, and number of under-five years children within house hold); Health, nutrition status, and sanitation characteristics (vaccination, fever status, and frequency of washing hands, practice of washing child utensils, and child feeding status); Environment and related characteristics (Source of water supply, Place of residence, availability of latrine, place of delivery, source of drinking water, availability of enough water at home per day, frequency of changing water in household storage, and water treatment methods)

Data Analysis and presentation

Collected data was cleaned, coded, and entered into Epi-data version 4.2 and analyzed with SPSS version 23. Chi-square assumptions were checked for all independent variables. Binary logistic regression was used to analyze the association between dependent variable and independent variables. All independent variables in bivariate analysis with P-value ≤ 25% at crude odds ratio (COR) of 95% confidence interval (CI) were considered as candidate for final model of multivariable analysis to control all possible confounders. In multivariable analysis, P-value < 5% was considered to report factors that had a statistically significant association with the outcome variable with adjusted odds ratio (AOR) 95%CI. For model fitness, Hosmer-Lemeshow goodness of fit was checked and it was 0.945. The results were presented in tables, and text.

Ethical consideration

This study was carried out in accordance with the Declaration of Helsinki. Ethical approval was obtained from the ethical review committee of the College of Natural Sciences, Jimma University. Written informed

consent was obtained from each study participants. Anonymity and confidentiality of the participants information was assured throughout.

Results

Socio-demographic characteristics

Out of 2233 recruited study participants, only 2030(90.9%) participants' data were considered for analysis while the rest 203(9.1%) questionnaires were excluded due to incompleteness. Just less than three-fifths 1179(58.1%) of under-five children participated in this study were females. Higher proportion of 763(37.6%) of the participants' age were below five months while mean age were 14.81±14.68 months. Also, the mean number of under-five children in the household was 1.53±0.578. Just less than seven-tenth 1390(68.5%) of the respondents were rural residents. Higher proportion 824(40.6%) of the respondents born in Jimma zone while the least 455(22.4%) were born in Dawro zone. Nearly half 899(44.5%) of guardians/mothers of the index under-five child had no formal education. Moreover, higher proportion 1096(54%) of the mothers'/guardians' occupation was housewife (Table 1).

Table 1
Socio-demographic characteristics of mothers/guardians of child under-five years old and their index child in southwest Ethiopia, 2021, (n=2030)

Variables	Categories	Frequency	Percent (%)
Sex of Child	Female	1179	58.1
	Male	851	41.9
Age of child in months	0-5	763	37.6
	6-11	328	16.2
	12-23	469	23.1
	24-35	176	8.7
	36-59	294	14.5
Number of under five children within a household	≤ 2	1976	97.3
	>2	54	2.7
Place of Birth	Jimma Zone	824	40.6
	Illubabor Zone	751	37.5
	Tercha Zone	455	22.4
Residence	Rural	1390	68.5
	Urban	640	31.5
Birth order	First Birth	453	22.3
	2-3	919	45.3
	4-5	615	30.3
	6+	43	2.1
Mothers'/guardians' education level	No formal education	899	44.3
	Primary	428	21.1
	Completed primary	336	16.6
	Secondary and above	367	18.1
Occupation	Housewife	1096	54
	Employed	468	23.1
	Self employed	466	23

Health, nutrition, and sanitation characteristics

Only one-fifths 423(20.8%) of the under-five children participants were fully vaccinated with all basic vacinations. Just more than two-thirds 838(41.3%) of the children had fever during the data collection time. Seven-tenth 1426(70.2%) of mothers/guardians of the index under-five child had always washed their hands after visiting toilet while the higher proportion 1118(55.1%) of frequent hand washing practice was by using water and soap. But the higher proportion 642(31.6%) of mothers/guardians child's utensils was frequently washed by using water only. Also, around one-thirds 649(32%) of the respondents' index child feed by themselves (Table 2).

Table 2
Health, nutrition status, and sanitation characteristics among under-five children and their mothers/guardians in south West Ethiopia, 2021, (n=2030)

Variables	Categories	Frequency	Percent (%)
Fully vaccinated of infant vaccination	Yes	423	20.8
	No	1607	79.2
Had fever	Yes	838	41.3
	No	1192	58.7
Mothers/guardians always washed their hands after visiting toilet	Yes	1426	70.2
	No	604	29.8
Mothers/guardians always washed their hands before eating and feeding the child	Yes	1423	70.1
	No	607	29.9
Frequent hand washing practice	With water only	912	44.9
	With water and soap	1118	55.1
What used frequently for washing child's utensils?	Cool water only	642	31.6
	Hot water only	393	19.4
	Cool water and soap	960	47.3
	Hot water and soap	35	1.7
Does your child feed on her/his own?	Yes	649	32
	No	1381	68

Environment and related characteristics

One-fourths 511(25.2%) of the study participants used water from unprotected source. Majority 1714(84.4%) of the study participants had latrine facility. Just more than half 1150(56.7%) of the index under-five child were born in health facility. Around two-fifths 498(44.2%) of the study participants had not gained enough water daily and one-fifths 388(19.1%) of the participants did not use any water treatment method (Table 3).

Table 3
Environmental and related characteristics among under-five children in southwest Ethiopia, 2021, (n=2030)

Variables	Categories	Frequency	Percent (%)
Source of water supply	Unprotected	511	25.2
	Protected	1519	74.8
Availability of Latrine	Yes	1714	84.4
	No	316	15.6
Place of delivery	Home	880	43.3
	Health facility	1150	56.7
Availability of enough water at home daily	Yes	1132	55.8
	No	498	44.2
Frequency of replacing water in the storage	Everyday	1475	72.7
	Every 2 days	450	22.2
	Every 3 days	74	3.6
	Every 4 or more days	31	1.5
Common water treatment method used	Boiling	333	16.4
	Filtering	176	8.7
	Chlorination	1133	55.8
	None	388	19.1

Prevalence of Diarrhea Morbidity and Factors Associated with it

The two weeks prevalence of diarrhea morbidity among under-five children in southwest Ethiopia was 701(34.53%). The multivariable binary logistic regression analysis result revealed that sex, age of child, mothers' or guardians' education level, place of residence, and birth order were associated with prevalence of diarreal morbidity (Table 4). Also, always washing hands after toileting, frequency of child's utensils washing practice, source of water supply, availability of latrine, frequency of replacing water in

the household storage, and child feeding practice were factors statistically significantly associated with prevalence of diarrhea among under-five children in southwest, Ethiopia (Table 5).

Table 4
Bivariate and multivariable analysis of socio-demographic variables with diarrhea morbidity among under-five children in southwest Ethiopia, 2021, (n=2030)

Variables	Categories	Diarrhea Morbidity		COR (95% CI)	AOR (95% CI)
		Yes (%)	No (%)		
Sex	Female	360(30.5)	819(69.5)	0.66(0.55-0.79)	.26(.17-.4)
	Male	341(40.1)	510(59.9)	1	1
Age of Child	0-5	239(31.3)	524(68.7)	0.55(0.42-0.73)	2.51(1.22-5.16)
	6-11	48(14.6)	280(85.4)	0.208(0.14-0.3)	4.66(2.32-9.33)
	12-23	186(39.7)	283(60.3)	0.796(0.59-1.07)	4.37(2.32-8.24)
	24-35	95(54)	81(46)	1.42(0.98-2.07)	0.77(0.38-1.56)
	36-59	133(45.2)	161(54.8)	1	1
Mothers'/guardians' education level	None	444(49.4)	455(50.6)	3.557(2.68-4.7)	3.55(1.97-6.4)
	Primary	111(25.9)	317(74.1)	1.277(.918-1.78)	2.89(1.41-5.9)
	Completed primary	67(19.9)	269(80.1)	0.908(.63-1.31)	1.37(.74-2.56)
	Secondary or above	79(21.5)	288(78.5)	1	1
Residence	Urban	163(25.5)	477(74.5)	0.541(0.44-0.67)	0.48(0.28-0.84)
	Rural	538(38.7)	852(61.3)	1	1
Birth order	First birth	178(39.3)	275(60.7)	0.196(0.1-0.41)	.08(.03-.26)
	2nd -3rd	273(29.7)	646(70.3)	0.128(0.06-0.26)	.06(.02-.19)
	4th -5th	217(35.3)	398(64.7)	0.165(0.08-0.34)	.1(.03-.31)
	≥ 6th	33(76.7)	10(23.3)	1	1

Notes: Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; COR,crude odds ratio.

Table 5
Bivariate and multivariable analysis of environmental, nutrition, and sanitation variables with diarrhea morbidity among under-five children in southwest Ethiopia, 2021, (n=2030)

Variables	Categories	Diarrhea Morbidity		COR (95% CI)	AOR (95% CI)
		Yes (%)	No (%)		
Always washed hands after toileting	Yes	486(34.1)	940(65.9)	0.94(0.77-1.14)	.58(.26-.66)
	No	215(35.6)	389(64.4)	1	1
What used frequently for washing child's utensils?	Cool water only	269(41.9)	373(58.1)	0.43(0.21-0.86)	1.2(0.86-1.62)
	Hot water ony	234(59.5)	159(40.5)	0.87(0.426-1.78)	1.9(1.4-2.62)
	Cool water & soap	176(18.3)	784(81.7)	0.13(0.07-0.27)	2.8(2.12-3.57)
	Hot water &soap	22(62.9)	13(37.1)	1	1
Source of water supply	Unprotected	270(52.8)	241(47.2)	2.83(2.3-3.48)	3.6(2.13-6.13)
	Protected	431(28.4)	1088(71.6)	1	1
Availability of latrine	Yes	490(28.6)	1224(71.4)	0.2(0.154-0.257)	.03(.02-.05)
	No	211(66.8)	105(33.2)	1	1
Frequency of replacing water in the storage	Everyday	572(38.8)	903(61.2)	1.82(0.8-4.1)	.02(.004-.05)
	Every 2 days	69(15.3)	381(84.7)	0.52(0.22-1.2)	.07(.02-.24)
	Every 3 days	52(70.3)	22(29.7)	6.8(2.64-17.5)	.2(.07-.59)
	Every 4 or more days	8(25.8)	23(74.2)	1	1
Does your child feed on her/his own?	Yes	296(45.6)	353(54.4)	2.021(1.7-2.45)	2.4(1.57-3.74)
	No	405(29.3)	976(70.7)	1	1

Notes: Abbreviations: AOR, adjusted odds ratio; CI, confidence interval; COR,crude odds ratio.

The odds of having diarrhea among female under-five children was 74% lesser than the male once (AOR 0.26; 95% CI= .172-.4). The odds of having diarrhea among children in the age range ≤5 months, 6–11 months, and 12–23 months were 2.51 times (AOR 2.51; 95% CI= 1.22- 5.16), 4.66 times (AOR 4.66; 95%

CI= 2.32 to 9.33), and 4.37 times (AOR 4.37; 95% CI= 2.32 to 8.24) higher than those children whose age was in between 36-59 months respectively. The odds of having diarrhea among under-five children whose mothers'/guardians' had no formal education, and had primary education were 3.55 times and 2.89 times higher than the children whose mothers'/guardians' had secondary education or above respectively (AOR 3.55; 95% CI= 1.97 to 6.4), (AOR 2.89; 95% CI:=1.41 to 5.9). The odds of having diarrhea among under-five children who lived in urban area was 52% lesser than the rural resident under-five children (AOR 0.48; 95% CI= 0.28 to 0.84). The odds of having diarrhea among under-five children whose birth order was first, second to third, and fourth to fifth was 92%, 94%, and 90% lesser than the children whose birth order was sixth or above respectively *(*AOR .08; 95% CI= .03-.26), (AOR .06; 95% CI= .02-.19), and (AOR .1; 95% CI= .03-.31) (Table 4).

The odds of having diarrhea among under-five children whose hands washed always after toileting was 42% lesser than their counter part (AOR .58; 95% CI= .26-.66). The odds of having diarrhea among under-five children whose utensils frequently washed by hot water only, and cool water with soap was 1.9, and 2.8 times higher respectively compared to the children whose utensils was frequently washed by hot water and soap (AOR 1.9; 95% CI= 1.4-2.62), and (AOR 2.8; 95% CI= 2.12-3.57). Also, the odds of having diarrhea among under-five children whose household used unprotected water source was 3.6 times higher than those used protected water source (AOR 3.6; 95% CI= 2.13-6.13).

Moreover, the odds of having diarrhea among under-five children whose household had latrine facility were 97% lesser than their counter part (AOR .03; 95% CI= .02-.05). The odds of having diarrhea among under-five children whose family replace water in the storage daily, every other day, and every three days was 98%, 93%, and 80% lesser than those whose who replace water in storage every four or more days respectively (AOR .02; 95% CI= .004-.05), (AOR .07; 95% CI= .02-.24), (AOR .2; 95% CI= .07-.59). Lastly, the odds of having diarrhea among under-five children who feed by themselves was 2.4 times higher than those feed by the support of their parents (AOR 2.4; 95% CI= 1.57-3.74)

Discussion

In the current study, just more than one-thirds 701(34.53%) of the under-five children in the southwest Ethiopia had diarrheal morbidity within two weeks before the data collection period. Eleven variables were statistically significantly associated with diarrheal morbidity among the study participants. Those variables were child sex, child age, mothers' or guardians' education level, place of residence, the child's birth order, washing hands after toileting, what frequently used for washing child's utensils, source of water supply, availability of latrine, frequency of replacing water in the household storage, and child feeding practice.

The prevalence of diarrheal morbidity among the study participants of the current study was higher than the result of study done in different parts of Ethiopia where the prevalence of diarrheal morbidity was ranged from 10.2–30.9% [22–26]. Also, the prevalence of diarrheal morbidity among the current study participants was more than two-folds higher than the result of study done in thirty-four sub-Saharan

Africa countries where the prevalence of diarrhel morbidity was 15.3% [16]. This significant dicripancy can be attributed to different factors such as difference in water source the study participants used, climatic condition of the study area [30], latrine facility, and sanitation practices. This imply that concerned bodies should give due attention to mitigate high prevalence of diarrheal morbidity and its negative consequences in southwest part of Ethiopia.

Females under-five children had lower odds of diarrheal morbidy than males in the current study. This finding is consistent with the finding of study done on Ethiopian demographic health survey [31], in north Ethiopia [32], and Bangladish [33]. Even though the reason why the odds of diarrheal morbidity was lower among females was not clearly stated in diferrent studies [31, 33, 34], may be it could be due to the fact that since females mostly focus on keeping their cleanliness and hygein, they contemporarly reduce their risk for diarrhea than males.

Children younger than 23 months had higher odds of diarrhea morbidity compared to those aged 36 to 59 months in the current study. This is in line with the finding of another study done on Ethiopian demographic health survey where the odds of diarrhea among children older than 25 months was 50% lesser than their younger counter parts [31]. The possible reason behind could be due to the fact that children less than two years old are more at risk of diarrhea as they may not gain exclusive breast feeding before 6 months, had immatured immunity, may not optimally adapted to complementary feeding after 6 months, and can be more contaminated while crawling.

The higher maternal education was associated with lower odds of having diarrhea among the current study participants. This is in line with the result of study done in Afganistan [35], northwest Ethiopia [16], and at country level [31]. The possible reason behind could be that the more educated mothers probably had better understanding and practice of diarrhea prevention methods that is supported by evidence to reduce diarrhea prevalence [29, 36]. The urban residents had less odds of diarrheal morbidity than the rural residents in the current study. This is in line with study done at national level in Ethiopia [16, 31]. The possible justification can be that urban residents may have better access to safe drinking water, latrine facility, and better knowledge than rural residents thereby comparatively staying safer from diarrheal morbity.

The under-five children who was born on fifth or less birth order had less odds of diarrheal morbidity than children who was born at sixth or more birth order among the current study participants. This finding is consistent with the findings of study done in central Ethiopia [23], and Jig-Jiga district [37], where diarrhea was common among second-born and fourth-born children compared to first-born children. The possible reason behind can be the difference in attention by which the mothers care for their children. Thus, mothers are more likely to care better for their comparatively lower birth order child as the load of responsibility to care for many children exhausts them when they had more children.

The odds of diarrheal morbidity among children who always washed hands after toilet was lesser than their counterparts in the current study. This is in line with the finding of systemic review in Ethiopia [38]. This can simply justified as it is general fact that frequent hand washing after toilet and before eating

food is main way of preventing diarrhea [39]. Also, washing child utensils by hot water and soap was associated with reduced odds of diarrheal morbidity than washing utensils by cool water with soap, and water only. This is in line with the scientific fact that hot water kills pathogenic microorganisms and can break grease that can hamper microorganisms on the utensils thereby preventing maximum cleaning power [40].

The odds of diarrheal morbidity among participants who had latrine facility was significantly very low than their counter parts. This is in line with the findings of other studies in the country [21, 38], and in India [15]. The possible justification can be that having latrine facility is protective from open defication from which flies can contaminate child food leading to diarrheal morbidity. Also, there was lesser odds of diarrheal morbidity among participants who replaced drinking water in household storage every one to three days compared to those who replaced every four or more days in the current study. Even if there is lack of evidence on the optimal frequency of changing drinking water in the house hold storage, the finding of the current study can be supported by the evidence that storing water can increase its risk of contamination [41]. Thus, water stayed in storage for longer time may increase the risk of diarrheal morbity.

Using unprotected water source either for drinking or other domestic purpose was associated with higher odds of diarrheal morbidity in the current study. This was reported in other study done in northwest [42], and southern Ethiopia [43]. Also, under-five children who feed by themselves had higher odds of diarrheal morbidy than those feeded by their care takers in the current study. This can be due to increased chance of contamination of childs food as the child may not properly clean their hands or may also touch contaminated surfaces even by the time they were eating. Also, children may eat uncooked foods, or foods stayed long after cooked thereby maximizing their chance of developing diarrhea [44].

Strengths And Limitation

This study was conducted in unstudied part of the country by using large sample size. Thus, its' results will have practical applicability to deal with the issue appropriately. To reduce recall bias, we asked the study participants for the event of having diarrhea or not within only two-weeks preceding the study period. To diminish information bias; we used a pre-tested questionnaire for data collection, and we trained data collectors and supervisors. To reduce error during data entry and analysis, we used Epi-data, v.4.2 and analysis done by SPSS v.23. However, since our study participants were under-five children brought to the hospital for seeking health care for whatever illness they had, this may increased prevalence of diarrhea. Thus, it was better to supplement this study finding by community based study.

Conclusion

The prevalence of diarrheal morbidity among under-five children in southwest Ethiopia was unacceptably high compared to the findings of studies done in different parts of the country. Eleven factors associated were statistically significantly associated with diarrheal morbidity. Those factors were being female

child, child age below 23 months, mothers' or guardians' education education level, being urban resident, child birth order, frequent hand washing practice, washing child utensils by cool-water and soap, unprotected water source, having latrine, frequency of replacing water in household storage, and child-self feeding. Thus, it is urgent that the parents, health extension workers, the zonal health departments, and all concerned bodies should struggle their best to strengthen the practices of diarrhea preventive methods and to avoid the risk factors thereby contributing in reduction of diarrheal morbidity in southwest Ethiopia.

Abbreviations

AOR: adjusted odds ratio; CI: confidence interval; COR: crude odds ratio

Declarations

Ethics approval and consent to participate

This study was carried out in accordance with the Declaration of Helsinki. Ethical approval was obtained from the ethical review committee of the College of Natural Sciences, Jimma University. Written informed consent was obtained from each study participants. Anonymity and confidentiality of the participants information was assured throughout.

Consent for publication

All authors were consented for publication of this manuscript in this journal.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available due to the fact that we are preparing another manuscript from it but are available from the corresponding author on reasonable request.

Competing interests

All authors declare that they don't have any conflict of interest

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Authors' contributions

All authors made a significant contribution to the work reported throughout starting from the conception of the research idea, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas; took part in drafting, revising, or critically reviewing the article; gave final approval of the

version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work

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