



The Burden of Diarrheal Diseases and Its Associated Factors among Under-Five Children in Welkite Town: A Community Based Cross-Sectional Study

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Wolde D, Tilahun GA, Kotiso KS, Medhin G and Eguale T (2022) The Burden of Diarrheal Diseases and Its Associated Factors among Under-Five Children in Welkite Town: A Community Based Cross-Sectional Study. Int J Public Health 67:1604960. doi: 10.3389/ijph.2022.1604960 **Objective:** This study assessed the magnitude of diarrhea and associated risk factors among under-five children in Welkite town.

Methods: We used a community-based cross-sectional study design. Data collection period was February to March 2021 and 426 parents/guardians of under-five children were the study participants. A structured questionnaire and observation checklist were used to collect the data.

Results: The 2 weeks prevalence of diarrhea among under-five years old children was 20.7% (88/426); 95% CI (17.1, 24.6). The child's mother/caregiver being merchant (AOR: 5.34; 95% CI: 2.1, 13.8) compared to housewife, partial immunization status (AOR: 2.67; 95% CI: 1.2, 5.8), disposing child's stool into the garbage (AOR: 5.05; 95% CI: 1.1, 23.3) compared to putting in a toilet, not covering water storage materials (AOR: 2.4; 95% CI: 1.2, 4.7) and presence of flies in food preparation area (AOR: 2.24; 95% CI: 1.05, 4.8) were associated with increased odds of having diarrhea.

Conclusion: The prevalence of diarrhea among under-five old children is high and it is associated with the occupation of the mothers/caregivers, the immunization status of children, unhygienic water storage condition and non-hygienic household practice.

Keywords: diarrhea, prevalence, caregivers, risk factors, Ethiopia

Abbreviations: AOR, Adjusted Odds Ratio; ODK, Open Data Kit; WHO, World Health Organization.

INTRODUCTION

Diarrheal disease is a major public health problem throughout the world and is responsible for high morbidity and mortality and is among the leading causes of outpatient visits, hospitalization, and the global year of life lost (YLL) in people of all ages [1]. Approximately 1.6 million deaths occur each year globally due to diarrhea with the highest-burden occurring in developing countries and economically disadvantaged regions [2].

Globally, diarrhea contributed to 15% of all under-five deaths [3, 4]. Of all child deaths from diarrhea, 78% occur in the African and Southeast Asian regions [5–7]. In these regions, diarrhea accounts for one in eight deaths among children younger than 5 years per annum [8]. Although the mortality from diarrhea has declined considerably over the past 25 years globally, diarrhea-associated morbidity in sub-Saharan Africa remains unacceptably high [9]. By 2030, it is estimated that 4.4 million children under the age of five will die from infectious diseases annually and that 60% of those deaths will occur in sub-Saharan Africa unless the appropriate measure is taken [10].

Ethiopia is the second-most populous country in Africa with a population of over 110 million and of these; more than 14% are children under-five years of age [11]. Regardless of the interventions undertaken, the burden of diarrheal disease is high, and there is a considerable variation in the prevalence and determinant factors of diarrhea in different localities of the country. Compared to other sub-Saharan African countries, Ethiopia accounts higher incidence of diarrheal diseases contributing to avoidable deaths [12, 13] and the diarrheal disease accounts for 9% of child mortality [14].

Diarrhea has been associated with reduced growth, impaired cognitive function, reduced vaccine efficacy, disruption of physical and educational development in children [15–18]. Factors determining the occurrence of diarrhea are complex, and the relative contribution of each factor varies as a function of the interaction between socioeconomic, environmental, and behavioral variables [15, 19]. The occurrence of diarrhea is associated with unsafe drinking water and poor sanitation in about 90% of the cases [20]. Sub-Saharan Africa showed slower progress in sanitation coverage, reaching 31% in 2015 from 24% in 1990 [21].

Accurate information on prevalence and factors associated with childhood diarrhea in the Welkite town remains virtually unknown. The aim of this study was assess the prevalence of diarrhea in the past 2 weeks and determine the contribution of socioeconomic, environmental, and behavioral factors to the occurrence of diarrhea among under-five children in Welkite town.

METHODS

Study Area and Setting

The study was conducted at Welkite town from 1 February to 30 March 2021. Welkite town is the administrative center of the Gurage zone of the Southern Nations, Nationalities, and Peoples' Region (SNNPR). The town is located at a latitude and longitude of 8017'N37047'E and an elevation between 1910 and 1935 m above sea level (**Figure 1**). It is located 155 km west of capital city of the county, Addis Ababa. The town has three sub-cities and six kebeles (the smallest administrative unit) and it is one of the most densely populated towns in Ethiopia with an average population density of 283 people/km².

Study Design and Population

A community-based cross-sectional study design was employed. The source population was all the under-five year children living in Welkite town, and the study population was under-five children living in the selected kebeles of Welkite town.

Sample Size Determination

Sample size was estimated for a 2 week recall period based on a previous report of 21.3% among under-five children in Halaba special district, in southern Ethiopia [22]. With a 95% confidence level, the margin of error of 5%, and design effect of 1.5 and 10% non-response. This resulted in the final sample size of 426.

Sampling Technique and Sampling Procedures

Multi-stage sampling was used to obtain a representative sample of the study participants. First, three Kebeles (the smallest administrative unit) were selected from the total six kebeles in the town using a random sampling technique. Household lists having under-five children were taken from health extension workers' registration books in each kebele. Codes were given to each household, and computer-generated random numbers were used to select the households. A lottery method was employed to select one child in case more than one child younger than 5 years old was found in the household (**Figure 2**).

Data Collection Methods and Instruments

Socio-demographic, behavioral, environmental, and other related data were collected from mothers/primary caretakers using a structured questionnaire and observation checklists. The questionnaire was adapted from similar studies and customized accordingly. One trained data collector was recruited in each selected kebele and the principal investigator monitored the overall data collection process. Data collectors have been trained about interview methods, consent, and ethical aspects required to be executed during data collection.

Data Analysis

Data was collected by Open Data Kit (ODK) version 1.27.3 (https:// apkpure.com/odk-collect/org.odk.collect.android/download/), and it was exported to SPSS version 25 (IBM Corp., Armonk, NY: IBM Corp.) for analysis. Depending on the distribution of the continuous variables, mean (standard deviation), or median (interquartile ranges) was used to describe the variables, and categorical variables were reported as a number and percentage. The Shapiro-Wilk test was used to evaluate the normality of the quantitative data. Logistic regression was used to identify factors associated with diarrhea status after checking all the preliminary assumptions of the model. Variables with a *p*-value < 0.20 in bivariate analysis were selected as





candidate variables to be included in a multivariable analysis in order to control for confounders. Variables with a *p*-value ≤ 0.05 in multivariable analysis were reported as being statistically significant, and AOR with 95% CI was reported as measures of the strength of the associations. The explanatory variables were tested for multi-collinearity using the Variance Inflation Factor (VIF) and the tolerance tests.

Operational Definitions

Diarrhea is the passage of three or more abnormally loose, watery, or liquid stools over 24 h periods

Immunization Status

Completely immunized children were those who received all childhood vaccines according to Ethiopia national immunization program for (polio, rotavirus, tuberculous meningitis, and military tuberculosis, pneumonia, diphtheria, pertussis, tetanus, Hemophilus influenza type b, Hepatitis B, and measles).

Partially immunized children were those who received one or more doses of the primary doses of the National Immunization Schedule but not completed all of them.

Safe child stool disposal practice: a child uses a toilet facility or the child's feces are put into a toilet (regardless of the type of toilet) or buried.

Overcrowding is a condition in which one bedroom is shared by three or more people.

Disposal of household rubbish: Proper solid waste disposal entails burying or storing waste in a container and disposing of it at a designated location. Household trash is improperly disposed of by being placed in open spaces and in roadside ditches along with other garbage.

Environmental sanitation: Environmental sanitation includes human excreta control, managing solid waste and wastewater, and pest and vector control.

RESULTS

Socio-Economic and Demographic Characteristics

A total of 426 under-five-year-old children participated in the study with 100% response. Respondents were children's mothers/primary caregivers and 363 (85.2%) of the respondents were biological parents. The majority 263 (61.8%) of the respondents had primary or secondary levels of education. Of the respondents, 227 (53.3%) were housewives and 101 (23.7%) were government employees. The majority 257 (60.3%) of the study respondents had an independent house with a roof constructed from a corrugated iron sheet. Of the total households included in the study, 352 (82.6%) and 143 (33.6%) had dwellings made of wood and mud wall and mud floor respectively. One hundred ninety-two (45.1%) respondents reported that >4 persons live per household. Households included in this study had 4.57 ± 1.50 SD average family size and each household on average had 2.59 ± 1.21 SD rooms.

The median age of children was 30.5 months with an Interquartile range (IQR) of (19.75–42.25). Most 313 (73.5%) of participants were in the age group of 24–59 months. There were slightly more 217 (50.9%) males than females.

About two-thirds, 266 (62.4%) of the study participants were not breastfeeding at the time of the study but on average they have fed for $21.38\pm$ (6.73 SD) months. Most, 331 (77.7%) of participants were fully vaccinated (**Table 1**).

Behavioral and Environmental Characteristics

Two hundred ninety-two (68.5%) of the respondents had frequent handwashing habits. Of the total respondents, 288 (67.6%), 185 (43.4%), and 255 (59.9%) wash their hands after the toilet, after cleaning, and before feeding the child respectively. Household members of 33 (7.7%), 139 (32.6%), and 190 (44.6%) had the habit of consuming raw milk, raw vegetable, and overnight stored foods after its preparation, respectively. From the observation of household environment, it was found that 206 (48.4%) of water storage area and 88 (20.7%) of water-storing materials were not clean and not covered, respectively. With regards to the food preparation area, 251 (58.9%) households prepare food in the unclean area and there were flies in 89 (20.9%) of households' food preparation area. The majority 288 (67.6%) of households had improved latrine and almost half 217 (50.9%) of them had private latrine used only by a given household. About three-fourth, 318 (74.6%) of households dispose of their child's stool in the toilet. Faeces were observed outside the toilet in 71 (16.7%) of the households and there were flies in 145 (34.1%) households. Almost all households 385 (90.8%) had no handwashing facility. There were human and animal faces lying around the house in 10 (2.3%) and 24 (5.6%) of households respectively. Children playing with animal feces lying around the house were observed in 23 (5.3%) of the households (Table 2).

Respondents from 109 (25.6%) households reported the presence of domestic animals in their house and most 82 (75.2%) reported that animals stay outside the dwelling at night. Of the reported animal type present in the household, 42 (38.5%) and 34 (31.2%) were cats and chickens, respectively. Children had close contact with animals in about one-third 37 (33.9%) of households where the presence of animals was reported.

Prevalence of Two Weeks Diarrhea and Its Associated Factors

The 2-week prevalence of diarrhea among under-five children was 20.7% (88/426) (95% CI: 17.1%, 24.6%). In bivariate analysis, child's immunization status, mother's/caregiver's educational status, mother's/caregiver's occupation, number of people sharing a sleeping room, breastfeeding, child's stool disposing practice, eating prepared food after overnight storage, cleanness of water storage area, water storage material being covered, cleanness of food preparation area, presence of flies in food preparation area and detection of feces outside a toilet were identified as candidate variables for the multivariable analysis. In

Relation of the respondent to the child Mothers/father Sister/brother 49 (11.5) 8. Aunt/uncle 24 (5.6) 3 Sex of children Male 217 (50.9) 46	79.3, 86.4 8.7, 14.3 3.5, 7.7 6.0, 55.6 4.4, 54.0 1.9, 5.4 2.1, 6.1
Mothers/father 353 (82.9) 75 Sister/brother 49 (11.5) 8 Aunt/uncle 24 (5.6) 3 Sex of children Male 217 (50.9) 46	79.3, 86.4 8.7, 14.3 3.5, 7.7 96.0, 55.6 14.4, 54.0 1.9, 5.4 2.1, 6.1
Sister/brother 49 (11.5) 8 Aunt/uncle 24 (5.6) 3 Sex of children 40 40	8.7, 14.3 3.5, 7.7 16.0, 55.6 14.4, 54.0 1.9, 5.4 2.1, 6.1
Aunt/uncle 24 (5.6) 3 Sex of children Male 217 (50.9) 46	3.5, 7.7 16.0, 55.6 14.4, 54.0 1.9, 5.4 2.1, 6.1
Sex of children Male 217 (50.9) 46	16.0, 55.6 14.4, 54.0 1.9, 5.4 2.1, 6.1
Male 217 (50.9) 46	46.0, 55.6 14.4, 54.0 1.9, 5.4 2.1, 6.1
	14.4, 54.0 1.9, 5.4 2.1, 6.1
Female 209 (49.1) 44	1.9, 5.4 2.1, 6.1
Age of children (in month)	1.9, 5.4 2.1, 6.1
<6 15 (3.5) 1	2.1, 6.1
6–11 17 (4.0) 2	
12–23 81 (19.0) 15	5.3, 22.8
24–59 313 (73.5) 66	9.5, 77.7
Immunization status of children	
Fully vaccinated 331 (77.7) 73	'3.9, 81.7
Partially vaccinated 95 (22.3) 18	8.3, 26.1
Education status of care givers	
No formal education 66 (15.5) 12	2.2, 19.0
Elementary (1–8) 151 (35.4) 31	31.2, 39.9
Secondary (9–12) 112 (26.3) 22	2.1, 30.3
Above secondary 97 (22.8) 18	8.8, 26.8
Occupation of respondents	
Government employee 101 (23.7) 19	9.5, 27.9
Merchant 48 (11.3) 8	8.2, 14.3
Student 50 (11.7) 8	8.7, 14.8
Housewife 227 (53.3) 48	8.4, 58.4
Monthly income	
<1000 ET birr 9 (2.1) C	0.9, 3.5
1,000–3,000 ET birr 173 (40.6) 35	35.9, 45.3
>3000ET birr 244 (57.3) 52	52.4, 62.2

the multivariable analysis the odds of having diarrhea among under-five years age children during the last 2 weeks was about five times higher among children whose mothers/caregivers are merchants as compared to children whose mothers/caregivers are housewives [AOR = 5.34; 95% CI: 2.06, 13.82]. Likewise, the odds of a child having diarrhea is 2.67 times higher among partially vaccinated children compared to fully vaccinated counterparts [AOR = 2.67; 95% CI: 1.23, 5.83]. Furthermore, the odds of a child having diarrhea is about two times higher in children living in a household where flies are found in a food preparation area than their counterpart [AOR: 2.24; 95% CI: 1.05, 4.78]. Additionally, the odds of diarrhea occurrence was about five times higher among children whose mothers/caregivers dispose of their stool into garbage than those who put child stools in the toilet [AOR = 5.05; 95%CI: 1.09-23.32]. Children living in households where water was stored without cover were 2.35 times more likely to develop diarrhea than their counterparts ([AOR = 2.35 (1.18, 4.66)]. The difference in the prevalence of diarrhea across categories of potential risk factors as compared to respective reference categories and findings from multi-variable logistic regression analysis are summarized in Table 3.

DISCUSSION

This study assessed the burden and risk factors of diarrhea among under-five children in Welkite town. In this study, 20.7% of

under-five children were reported to have diarrhea in the 2 weeks. This result is comparable with the study in Dakahlia, Egypt (23.6%) [23] and Malawi (20.7%) [24]. It is also comparable with the finding of studies conducted in different localities in Ethiopia such as Jamma district (23.1%) [25], Eastern Ethiopia (22.5%) [26], and Jabithenan district (21.5%) [27].

The magnitude of diarrhea in this study is higher than the Ethiopian national prevalence of diarrheal disease (12%) in under-five children reported by EDHS 2016 [28]. It is also higher than a study conducted in Dale district Sidama zone (13.6%) [20], Debre Brehan (16.4) [29], Kamashi district (14.5%) [30], and India (9.0%) [31]. However, it was lower than the finding from Arbaminch (30.5%) [32], Guji zone, Oromia region (36.5%) [33], Tigray region of Northern Ethiopia (27.2%) [34], Kashmir, India (25.2%) [35], Mbour, Senegal (26.0%) [36] and Northern Uganda (29.1%) [37]. The difference might be attributed to the variation in the socio-demographic, behavioral, and environmental factors of study households.

Most of the time paper currencies are contaminated with pathogenic microorganisms and they could be one of the most potential vehicles to transmit pathogens amongst people [38]. Proper handwashing is one of the most effective ways of preventing the spread of diarrheal diseases. In this study, mothers'/caregivers' occupation is identified as an independent predictor of diarrhea. The study revealed that the likelihood of having diarrhea is about five times higher among under-five TABLE 2 Behavioural and environmental characteristics of respondents in Welkite town, Gurage zone, southern Ethiopia, 2021.

Source of drinking water Tap water 387 (90.8) 88.0, 93. Source of drinking water 387 (90.8) 88.0, 93. Wel/spring 15 (3.5) 19.5 4 Bottled water 21 (4.9) 31, 7.0 Other 3 (0.7) 0, 1.6 Plastic jerrycan with cover 2 (0.5) 80.7, 95. How frequently do you clean your water fetching material? Once per day 77 (18.1) 14.6, 21.1 Once per day 77 (18.1) 14.6, 21.1 Once per week 224 (64.3) 59.9, 68. How frequently do you clean your water storing material? Once per day 77 (18.1) 14.6, 21.1 Once per day 71 (18.1) 14.6, 21.1 Once per week 224 (64.3) 59.9, 68. How frequently do you clean your water storing material? Once per day 38 (8.9) 6.1, 11.7. More per day 38 (8.9) 6.1, 11.7. Once per week 228 (61.5) 56.8, 65. No facilities or bush or field 3 (0.7) 0.0, 1.6 Flush toilet 29 (6.8) 47.9, 9.2 Ventiated improved pit (VIP) latrine 8	Characteristics	Response category	Number (%)	95% CI
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How frequently do you clean your water fetching material? Once per day 77 (18.1) 14.6, 21.4 Once per week 274 (64.3) 55.99, 38.8.22 Once per month 25 (5.9) 38.8.22 When I see it dirty 50 (11.7) 8.7, 14.82 How frequently do you clean your water storing material? 0nce per day 38 (8.9) 6.1, 11.7 Once per week 262 (61.5) 56.6, 65. 0nce per month 72 (16.9) 13.4, 20.4 When I see it dirty 54 (12.7) 9.9, 16.6 14.4, 20.4 When I see it dirty 54 (12.7) 9.9, 16.6 Kind of toilet facility 10.0 70.7, 0.0, 1.6 Flush toilet 3 (0.7) 0.0, 1.6 Flush toilet facility 29 (6.8) 4.7, 9.2 How do you dispose the stools of your young children? 0pen pit latrine 8 (1.9) 0.7, 3.3 Pit latrine with slab 251 (58.9) 54.2, 6.3. Other 0pen pit latrine 66 (15.5) 12.2, 18.2 Put in toilet 319 (74.9) 70.7, 78.5 How do you usually dispose of household rubbish? 0ther 25 (5.9) 3.8, 8.4 P		Other	30 (7.0)	4.7, 9.6
Once per day 77 (18.1) 14.6, 21.1 Once per week 274 (64.3) 59.9, 68.3 Once per month 25 (5.9) 3.8, 8.2 When I see it dirty 50 (11.7) 8.7, 14.6 How frequently do you clean your water storing material? Once per day 38 (8.9) 6.1, 11.7 Once per day 38 (8.9) 6.1, 11.7 0.6, 66. Once per week 262 (61.5) 56.6, 66. Once per month 72 (16.9) 13.4, 20.0 When I see it dirty 29 (6.8) 4.7, 9.2 Kind of toilet facility Image: the storing material Image: the storing material 261 (5.5) 3.6, 8.2 How do you dispose the stools of your young children? No facilities or bush or field 3 (0.7) 0.0, 1.6 Fluat inice Vitarine 163 (31.7) 2.5, 6.3 3.64.2, 6.3 How do you dispose the stools of your young children? Image: the storing material 2.6 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Image: the storing material 2.6 (5.9) 3.8, 8.4 How do you usually dispose of household rubbish?	How frequently do you clean your water fetching material?			
Once per week 274 (64.3) 59.9, 68.3 Once per month 25 (5.9) 3.8, 8.2 How frequently do you clean your water storing material? 0nce per day 38 (8.9) 6.1, 11.7 Once per day 38 (8.9) 6.1, 11.7 0nce per week 262 (61.5) 56.6, 65. Once per week 262 (61.5) 56.6, 65. 0.7 0.4, 42.0 When I see it dirty 54 (12.7) 9.9, 16.0 1.4, 42.0 When I see it dirty 54 (12.7) 9.9, 16.0 1.4, 42.0 When I see it dirty 54 (12.7) 9.9, 16.0 1.4, 42.0 When I see it dirty 54 (12.7) 9.9, 16.0 1.4, 42.0 Ventilated improved pit (MP) latrine 8 (1.9) 0.7, 3.3 1.6, 11.7 Put in toilet 29 (6.8) 4.7, 9.2 Ventilated improved pit (MP) latrine 8 (1.9) 0.7, 3.3 Put latrine with slab 251 (58.9) 54.2, 63.3 0.2, 7.5, 63. How do you dispose the stools of your young children? India use toilet/latrine 66 (15.5) 12.2, 16.8 How do you usually dispose of household rubbish?		Once per day	77 (18.1)	14.6, 21.8
How frequently do you clean your water storing material? Once per month 25 (5.9) 3.8, 8.2 How frequently do you clean your water storing material? Once per day 38 (8.9) 6.1, 11.7 Once per day 38 (8.9) 6.1, 11.7 Once per week 262 (61.5) 56.6, 65. Once per week 262 (61.5) 56.6, 65. Once per month 72 (16.9) 13.4, 20. Kind of toilet facility When I see it dirty 54 (12.7) 9.9, 16.0 Kind of toilet facility No facilities or bush or field 3 (0.7) 0.0, 1.6 Flush toilet 29 (6.8) 4.7, 9.2 Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 How do you dispose the stools of your young children? Toilet 29 (6.8) 54.2, 63.1 How do you usually dispose of household rubbish? Toilet 135 (31.7) 27.5, 36. How do you usually dispose of household rubbish? Toilet 39 (74.9) 70.7, 78.3 How do you usually dispose of household rubbish? Toilet 16 (3.8) 2.1, 5.6 How do you usually dispose of household rubbish? Toilet 25 (5.9) 3		Once per week	274 (64.3)	59.9, 68.5
How frequently do you clean your water storing material? When I see it dirty 50 (11.7) 8.7, 14.8 How frequently do you clean your water storing material? Once per day 38 (8.9) 6.1, 11.7, Once per day 38 (8.9) 6.1, 11.7, 0.6, 6.5, Once per week 262 (61.5) 56.6, 6.5, Once per month 72 (16.9) 13.4, 20. When I see it dirty 54 (12.7) 9.9, 15.0 Kind of toilet facility 54 (12.7) 9.9, 15.0 Kind of toilet facility 59 (6.8) 4.7, 9.2 Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 Pit latrine with slab 251 (58.9) 54.2, 6.3. Open pit latrine 615.5) 12.2, 18.3 Put in toilet 319 (74.9) 70.7, 78.3 Put in ordich 16 (3.8) 2.1, 5.6 Other <td></td> <td>Once per month</td> <td>25 (5.9)</td> <td>3.8, 8.2</td>		Once per month	25 (5.9)	3.8, 8.2
How frequently do you clean your water storing material? Once per day 38 (8.9) 6.1, 11.7. Once per week 262 (61.5) 56.6, 65. 0.0 Once per month 72 (16.9) 13.4, 20. When I see it dirty 54 (12.7) 9.9, 16.0 Kind of toilet facility 70 and for the see it dirty 54 (12.7) 9.9, 16.0 Kind of toilet facility 70 and for the see it dirty 59 (6.8) 4.7, 9.2 Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 9.1 How do you dispose the stools of your young children? 66 (15.5) 12.2, 18.4 How do you usually dispose of household rubbish? 7.0 7.7, 78.4 How do you usually dispose of household rubbish? 7.1 7.4 How do you usually dispose of household rubbish? 7.1 7.4 Hou in garden 24 (5.6) 3.5, 8.0 Put in in garden 24 (5.6) 3.5, 8.0 Put in in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 3.9, 4.8.4 Put in garden 24 (5.6) 3.5, 8.0		When I see it dirty	50 (11.7)	8.7, 14.8
Once per day 38 (8.9) 6.1, 11.7 Once per week 262 (61.5) 56.6, 65. Once per month 72 (16.9) 13.4, 20. When I see it dirty 54 (12.7) 9.9, 16.0 Kind of toilet facility 54 (12.7) 9.9, 16.0 Kind of toilet facility 70.0, 0, 1.6 10.0, 1.6 Flush toilet 29 (6.8) 4.7, 9.2 Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 Pit latrine with slab 251 (58.9) 54.2, 63.1 Open pit latrine 135 (31.7) 27.5, 36. How do you dispose the stools of your young children? 10.1 146 (3.8) 2.1, 56.6 How do you usually dispose of household rubbish? 10.1 16 (3.8) 2.1, 56.6 How do you usually dispose of household rubbish? 10.1 10.1 3.0, 70.0 3.8, 8.4 Put in drain or ditch 25 (5.9) 3.8, 8.4 9.2 3.8, 8.4 Put in garden 24 (5.6) 3.6, 8.0 3.0, 70.0 3.6, 8.0 Put in bush 30 (7.0) 4.7, 9.4 3.6, 8.0	How frequently do you clean your water storing material?			
Once per week 262 (61.5) 56.6, 65. Once per month 72 (16.9) 13.4, 20. When I see it dirty 54 (12.7) 9.9 (6.8) Kind of toilet facility 54 (12.7) 9.9 (6.8) Kind of toilet facility 50 (6.5) 10.0, 1.6 Flush toilet 29 (6.8) 4.7, 9.2 Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 Pit latrine with slab 251 (58.9) 54.2, 63.3 Open pit latrine 66 (15.5) 12.2, 18.4 Put in toilet 319 (74.9) 70.7, 78.4 Put in drain or ditch 16 (3.8) 2.1, 5.6 How do you usually dispose of household rubbish? 7 7.8 How do you usually dispose of household rubbish? 8ubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.1 Other 158 (37.1) 32.4, 41.5		Once per day	38 (8.9)	6.1, 11.7
Once per month 72 (16.9) 13.4, 20.4 When I see it dirty 54 (12.7) 9.9, 16.0 Kind of toilet facility 54 (12.7) 9.9, 16.0 Kind of toilet facility 54 (12.7) 9.9, 16.0 No facilities or bush or field 3 (0.7) 0.0, 1, 6 Flush toilet 29 (6.8) 4.7, 9.2 Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 Pit latrine with slab 251 (58.9) 54.2, 63.3 Open pit latrine 135 (31.7) 27.5, 36.5 How do you dispose the stools of your young children? Ventilated improved pit (VIP) latrine 66 (15.5) 12.2, 18.3 Put in toilet 319 (74.9) 70.7, 78.3 20.0 21.5, 56.5 Other 25 (5.9) 3.8, 82.4 21.1, 56.6 25.6, 59.9 3.8, 82.4 How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 84.4 Put in garden 24 (5.6) 3.5, 8.0 Open burning 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 3.94, 48.1 Ot		Once per week	262 (61.5)	56.6, 65.7
Kind of toilet facility 54 (12.7) 9.9, 16.0 Kind of toilet facility No facilities or bush or field 3 (0.7) 0.0, 1.6 Push toilet 29 (6.8) 4.7, 9.2 Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 Pit latrine with slab 251 (58.9) 54.2, 63.1 Open pit latrine 135 (31.7) 27.5, 36.5 How do you dispose the stools of your young children? No facilitatrine 66 (15.5) 12.2, 18.1 Put in toilet 319 (74.9) 70.7, 78.3 Put in toilet 319 (74.9) 70.7, 78.3 How do you usually dispose of household rubbish? Utin drain or ditch 16 (3.8) 2.1, 5.6 0.14, 5.6 How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 0.0 Open burning 30 (7.0) 4.7, 9.4 0.6 Vut in bush 30 (7.0) 4.7, 9.4 0.4, 4.8.1 Open burning 158 (37.1) 32.6, 4.1.3 32.6, 4.1.3		Once per month	72 (16.9)	13.4, 20.4
Kind of toilet facility No facilities or bush or field 3 (0.7) 0.0, 1.6 Flush toilet 29 (6.8) 4.7, 9.2 Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 Pit latrine with slab 251 (58.9) 54.2, 63.4 Open pit latrine 251 (58.9) 54.2, 63.4 Open pit latrine 251 (58.9) 70.7, 78.3 How do you dispose the stools of your young children? Thild use toilet/latrine 66 (15.5) 12.2, 18.4 Put in toilet 319 (74.9) 70.7, 78.4 21.1, 5.6 Other 25 (5.9) 3.8, 8.4 Put in drain or ditch 16 (3.8) 2.1, 5.6 Other 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.4 Other 188 (37.1) 32.6, 41.4		When I see it dirty	54 (12.7)	9.9, 16.0
No facilities or bush or field 3 (0.7) 0.0, 1.6 Flush toilet 29 (6.8) 4.7, 9.2 Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 Pit latrine with slab 251 (58.9) 54.2, 63.3 Open pit latrine 135 (31.7) 27.5, 36. How do you dispose the stools of your young children? Child use toilet/latrine 66 (15.5) 12.2, 18.3 Put in toilet 319 (74.9) 70.7, 78.3 Put in drain or ditch 16 (3.8) 2.1, 5.6 Ober 25 (5.9) 3.8, 8.4 Put in drain or ditch 16 (3.8) 2.1, 5.6 Other 25 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.4 Other 158 (37.1) 32.6, 41.4	Kind of toilet facility			
Flush toilet 29 (6.8) 4.7, 9.2 Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 Pit latrine with slab 251 (58.9) 54.2, 63.1 Open pit latrine 135 (31.7) 27.5, 36. How do you dispose the stools of your young children? Child use toilet/latrine 66 (15.5) 12.2, 18.1 Put in toilet 319 (74.9) 70.7, 78.1 Put in drain or ditch 16 (3.8) 2.1, 5.6 Other 25 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Put in garden 24 (5.6) 3.5, 8.0 Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.4 Other 158 (37.1) 32.6, 41.4		No facilities or bush or field	3 (0.7)	0.0, 1.6
Ventilated improved pit (VIP) latrine 8 (1.9) 0.7, 3.3 Pit latrine with slab 251 (58.9) 54.2, 63.4 Open pit latrine 135 (31.7) 27.5, 36. How do you dispose the stools of your young children? Child use toilet/latrine 66 (15.5) 12.2, 18.4 Put in toilet 319 (74.9) 70.7, 78.4 Put in drain or ditch 16 (3.8) 2.1, 5.6 Other 25 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Put in garden 24 (5.6) 3.5, 8.0 Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.4 Other 158 (37.1) 32.6, 41.4		Flush toilet	29 (6.8)	4.7, 9.2
Pit latrine with slab 251 (58.9) 54.2, 63.4 Open pit latrine 135 (31.7) 27.5, 36. How do you dispose the stools of your young children? Child use toilet/latrine 66 (15.5) 12.2, 18.4 Put in toilet 319 (74.9) 70.7, 78.4 Put in drain or ditch 16 (3.8) 2.1, 5.6 Other 25 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 9.4 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 0.0 0.4 (3.9), 4.4 (3.4) Open burning 189 (44.4) 3.94, 4.84 0.0 0.0 4.7, 9.4		Ventilated improved pit (VIP) latrine	8 (1.9)	0.7, 3.3
Open pit latrine 135 (31.7) 27.5, 36. How do you dispose the stools of your young children? Child use toilet/latrine 66 (15.5) 12.2, 18.1 Put in toilet 319 (74.9) 70.7, 78.1 Put in drain or ditch 16 (3.8) 2.1, 5.6 Other 25 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 9.4 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.4 Other 158 (37.1) 32.6, 41.4		Pit latrine with slab	251 (58.9)	54.2, 63.8
How do you dispose the stools of your young children? Child use toilet/latrine 66 (15.5) 12.2, 18.4 Put in toilet 319 (74.9) 70.7, 78.3 Put in drain or ditch 16 (3.8) 2.1, 5.6 Other 25 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 9.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.4 Other 158 (37.1) 32.6, 41.4		Open pit latrine	135 (31.7)	27.5, 36.1
Child use toilet/latrine 66 (15.5) 12.2, 18.4 Put in toilet 319 (74.9) 70.7, 78.4 Put in drain or ditch 16 (3.8) 2.1, 5.6 Other 25 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 9.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.4 Other 158 (37.1) 32.6, 41.4	How do you dispose the stools of your young children?			
Put in toilet 319 (74.9) 70.7, 78.9 Put in drain or ditch 16 (3.8) 2.1, 5.6 Other 25 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.1 Other 158 (37.1) 32.6, 41.4		Child use toilet/latrine	66 (15.5)	12.2, 18.8
Put in drain or ditch 16 (3.8) 2.1, 5.6 Other 25 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.1 Other 158 (37.1) 32.6, 41.4		Put in toilet	319 (74.9)	70.7, 78.9
Other 25 (5.9) 3.8, 8.2 How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.1 Other 158 (37.1) 32.6, 41.4		Put in drain or ditch	16 (3.8)	2.1, 5.6
How do you usually dispose of household rubbish? Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.1 Other 158 (37.1) 32.6, 41.4		Other	25 (5.9)	3.8, 8.2
Rubbish pit 25 (5.9) 3.8, 8.4 Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.1 Other 158 (37.1) 32.6, 41.4	How do you usually dispose of household rubbish?			
Put in garden 24 (5.6) 3.5, 8.0 Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.1 Other 158 (37.1) 32.6, 41.1		Rubbish pit	25 (5.9)	3.8, 8.4
Put in bush 30 (7.0) 4.7, 9.4 Open burning 189 (44.4) 39.4, 48.1 Other 158 (37.1) 32.6, 41.1		Put in garden	24 (5.6)	3.5, 8.0
Open burning 189 (44.4) 39.4, 48.1 Other 158 (37.1) 32.6, 41.1		Put in bush	30 (7.0)	4.7, 9.4
Other 158 (37.1) 32.6. 41.		Open burning	189 (44.4)	39.4, 48.6
		Other	158 (37.1)	32.6, 41.8

children if the mothers'/caregivers' occupation is a merchant as compared to a housewife. This might be related to the fact that merchants have frequent contact with paper currencies and people coming to buy and sell their products. They also have a high probability of hand contamination during handling items at their workplace. However, hand washing practice between money transactions was not reported by any respondent in this study. This may play a significant role in the transmission of diarrheagenic pathogens to their children. In addition, merchant mothers may not have enough time to take care of their children during the daytime, which may lead their children to poor hygiene and nutritional status.

Incomplete immunization status was also another risk factor identified as a predictor of diarrhea prevalence in children. In this study, the odds of having diarrhea is about three times higher among partially vaccinated children compared to fully vaccinated ones. This finding is in line with the study done in Ethiopia [33, 39] and West Bengal [40]. This may be because immunization can reduce mortality and morbidity from common childhood diseases including diarrhea by increasing their capability to combat disease. Among childhood vaccines, the rotavirus vaccine can directly prevent infections that cause diarrhea and measles vaccines can prevent infections that can lead to diarrhea as a complication of an illness [5].

Hygienic food preparation is recommended as a preventive measure for the control of diarrhea. This study indicated that the presence of flies in a food preparation area was positively associated with the occurrence of diarrhea. Children living in households where flies are found in food preparation areas were about two times more likely to develop diarrhea compared to the other group. This might be explained by the fact that the presence of houseflies in a food preparation area increases the risk of food contamination through direct contact with food by walking on the food or through their droppings. They are known to carry and transmit diarrhea-causing agents by mechanical transfer from the exoskeleton, regurgitation, and fecal deposit. Some enteropathogens can multiply in the gut of houseflies and can be excreted for more than weeks [41, 42]. This result is consistent with the study done in Ghana [43].

Safe disposal of feces is important to reduce the risk of contact between causative agents of diarrhea and the host. Unsafe disposal of child feces has been associated with an increased risk of diarrheal diseases. Disposal of child feces in the domestic TABLE 3] Risk difference in different categories and Multivariable Logistic Regression analysis results of factors associated with diarrhea among under-five year age children in Welkite town, Gurage zone, southern Ethiopia, 2021.

Location status No formal aducation 43 (65.2) 23 (34.8) 0.27 (0.14, 0.39) 0.55 (0.128, 2.368) 0.4422 Prinsry (1-6) 116 (76.8) 35 (32.2) 0.15 (0.06, 0.24) 0.55 (0.153, 1.883) 0.344 Becondary (9-12) 90 (80.4) 22 (19.6) 0.11 (0.02, 0.21) 0.52 (0.152, 1.789) 0.044 Student 37 (74.0) 13 (26.0) 0.04 (-0.09, 0.17) 2.47 (0.949, 6.443) 0.064 Government employce 93 (92.1) 8 (7.9) -0.14 (-0.22, -0.06) 0.58 (0.182, 1.850) 0.357 Marchant 32 (66.7) 16 (33.3) 0.11 (-0.03, 0.26) 5.34 (2083, 13.817) 0.001* Housewife 176 (77.5) 51 (22.5) 1 1 1 Press 118 (73.8) 42 (26.2) 1 1 1 No 220 (82.7) 46 (17.3) -0.09 (-0.173, -0.008) 0.74 (0.312, 1.749) 0.491 Yes 118 (73.8) 42 (26.2) 1 1 1 Child use toile/latins isstus 0.261 (0.043, 0.246) 2.67 (1.225,	Characteristics	Number (%) without diarrhea	Number (%) with diarrhea	Risk difference in different categories	AOR (95%Cl)	<i>p</i> -value
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Education status					
Interventional aboutation +9 (62.2) 20 (40.1) 0.21 (0.1.0.09) 0.05 (0.12, 2.00) 0.24 Primary (1-2) 90 (80.4) 22 (19.6) 0.11 (0.02, 0.21) 0.32 (0.152, 1.789) 0.300 Above secondary 99 (91.8) 8 (8.2) 1 1 1 Respondents Occupation 90 (80.1) 8 (7.9) -0.14 (-0.22, -0.06) 0.58 (0.182, 1.860) 0.367 Student 37 (74.0) 13 (26.0) 0.04 (-0.09, 0.17) 2.47 (0.949, 6.443) 0.300 Merchant 12 (60.7) 16 (133.3) 0.11 (-0.03, 0.25) 5.34 (2063, 1.3817) 0.0017 Housewife 176 (77.5) 51 (22.5) 1 1 1 0.0017 Hereast feeding 76 (17.3) -0.09 (-0.17, -0.008) 0.74 (0.312, 1.749) 0.491 No 2.20 (82.7) 46 (17.3) -0.09 (-0.17, -0.008) 0.74 (0.312, 1.749) 0.491 Immunization status Partial vaccinated 2.76 (82.5) 58 (17.6) 1 1 Partial vaccinated 2.56 (19.4) 9 (62.2) 0.36 (0.11, 0.61) 0.56 (1.94, 23.324) 0.339 Child stool disposal	No formal adjustion	42 (65.2)	22 (24 8)	0.27 (0.14, 0.20)	0.55 (0.128, 2.368)	0 422
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Primary (1-8)	116 (76.8)	25 (04.0)	0.15(0.06, 0.24)	0.55 (0.163, 1.883)	0.422
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Secondary $(9-12)$	90 (80 4)	22 (10.6)	0.13(0.00, 0.24)	0.52 (0.152, 1.789)	0.300
Respondents Occupation Cocus I </td <td>Above secondary</td> <td>80 (01.8)</td> <td>8 (8 2)</td> <td>1</td> <td>0.52 (0.152, 1.759) 1</td> <td>0.000</td>	Above secondary	80 (01.8)	8 (8 2)	1	0.52 (0.152, 1.759) 1	0.000
Description Comparison Constraint Constr	Respondents Occupation	03 (31.0)	0 (0.2)	1	•	
Decount Difference Difference <thdifference< th=""> Differenc Differenc<!--</td--><td>Student</td><td>37 (74 0)</td><td>13 (26.0)</td><td>0.04 (-0.09, 0.17)</td><td>2 47 (0 949 6 443)</td><td>0.064</td></thdifference<>	Student	37 (74 0)	13 (26.0)	0.04 (-0.09, 0.17)	2 47 (0 949 6 443)	0.064
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Government employee	93 (92 1)	8 (7 9)	-0.14 (-0.22 -0.06)	0.58 (0.182 1.850)	0.357
Introduction Oct (0,7) Th (0,0,5) CH (0,	Merchant	32 (66 7)	16 (33.3)	-0.14 (-0.22, -0.00) 0.11 (-0.03, 0.25)	5 34 (2 063 13 817)	0.001*
Theorem 259 ± 0.917 1.28 (0.918, 1.782) 0.144 Breadt feeding	Housewife	176 (77 5)	51 (22 5)	1	1	0.001
Induction of the length Induction Induction Induction Induction Induction No 220 (82.7) 46 (17.3) -0.09 (-0.173, -0.008) 0.74 (0.312, 1.749) 0.491 Yes 118 (73.8) 42 (26.2) 1 1 1 Partially vaccinated 65 (68.4) 30 (31.6) 0.145 (0.043, 0.246) 2.67 (1.225, 5.826) 0.013* Fully vaccinated 254 (79.6) 65 (20.4) 1 1 1 Child stool disposal - - - 0.667 (0.239, 1.860) 0.439 Thrown into garbage 7 (43.8) 9 (56.2) 0.36 (0.11, 0.61) 5.05 (1.044, 1.570) 0.139 Eating prepared food after overnight storage - - - 0.016* - 0.69 (0.369, 1.278) 0.236 Yes 139 (75.2) 67 (32.5) 0.23 (0.16, 0.31) 1 - 0.69 (0.369, 1.278) 0.236 Yes 139 (75.5) 67 (32.5) 0.23 (0.16, 0.31) 1 0.206 (0.854, 4.956) 0.108 Vas 199 (90.5) 2	People sleeping in one room	110 (11.0)	2 92 + 0 917	·	1 28 (0 919 1 782)	0 144
No. 220 (82.7) 46 (17.3) -0.09 (-0.173, -0.008) 0.74 (0.312, 1.749) 0.491 Yes 118 (73.8) 42 (26.2) 1 1 Immunization status Partially vaccinated 65 (68.4) 30 (31.6) 0.145 (0.043, 0.246) 2.67 (1.225, 5.826) 0.013° Full vaccinated 273 (82.5) 85 (17.5) 1 1 1 Child stool disposal -0.05 (-0.15, 0.05) 0.667 (0.239, 1.860) 0.439 Thrown into garbage 7 (43.8) 9 (56.2) 0.36 (0.11, 0.61) 5.05 (1.094, 2.3324) 0.038 Child stool differ overnight storage 1 (16.0) -0.04 (-0.20, 0.11) 0.251 (0.040, 1.570) 0.139 Eating prepared food after overnight storage 7 (43.8) 9 (56.2) 0.38 (0.11, 0.61) 0.251 (0.040, 1.570) 0.139 Ising prepared food after overnight storage 1 0.69 (0.369, 1.278) 0.236 0.24 (0.10, 0.07) 1 0.261 (0.040, 1.570) 0.139 Ves 139 (67.5) 67 (32.5) 0.23 (0.16, 0.31) 1 1 0.108 <td>Breast feeding</td> <td></td> <td>2.02 ± 0.011</td> <td></td> <td>1.20 (0.010, 1.102)</td> <td>0.111</td>	Breast feeding		2.02 ± 0.011		1.20 (0.010, 1.102)	0.111
No Left (73.6) Left (73.6) <thleft (73.6)<="" th=""> <thleft< td=""><td>No</td><td>220 (82 7)</td><td>46 (17.3)</td><td>-0.09 (-0.173 -0.008)</td><td>0.74 (0.312 1.749)</td><td>0 491</td></thleft<></thleft>	No	220 (82 7)	46 (17.3)	-0.09 (-0.173 -0.008)	0.74 (0.312 1.749)	0 491
The (Fibb) The (Fi	Yes	118 (73.8)	42 (26 2)	1	1	0.101
mmstand mmstand <t< td=""><td>Immunization status</td><td>110 (10.0)</td><td>12 (20.2)</td><td>·</td><td>·</td><td></td></t<>	Immunization status	110 (10.0)	12 (20.2)	·	·	
Fully accinated 273 (82.5) 58 (17.5) 1 1 1 Put in toilet 254 (79.6) 65 (20.4) 1 1 1 Child stool disposal -0.05 (-0.15, 0.05) 0.667 (0.239, 1.860) 0.439 Thrown into garbage 7 (43.8) 9 (56.2) -0.36 (0.11, 0.61) 5.05 (1.094, 23.324) 0.038 * Others 21 (84.0) 4 (16.0) -0.04 (-0.20, 0.11) 0.251 (0.040, 1.570) 0.139 Eating prepared food after ovenight storage -0.04 (-0.20, 0.11) 0.251 (0.040, 1.570) 0.139 Yes 139 (73.2) 51 (26.8) -0.16 (-0.10, 0.07) 1 0.236 Ves 139 (67.5) 67 (32.5) 0.23 (0.16, 0.31) 1 1 Ves 199 (90.5) 21 (9.5) 1 2.06 (0.854, 4.956) 0.108 Water storage material being covered 1 1 1 Ves 289 (85.5) 49 (14.5) 1 1 1 1 No 278 (82.5) 59 (17.5	Partially vaccinated	65 (68 4)	30 (31.6)	0 145 (0 043 0 246)	2 67 (1 225 5 826)	0.013*
Child stool disposal Circle (1, 1) Circle (1, 1) Put in tollet 254 (79, 6) 65 (20, 4) 1 1 Child stool disposal 0.055 (-0.15, 0.05) 0.667 (0.239, 1.860) 0.439 Dthrown into garbage 7 (43, 8) 9 (56, 2) 0.36 (0.11), 0.61) 5.05 (1.094, 23.324) 0.038 Others 21 (84.0) 4 (16.0) -0.04 (-0.20, 0.11) 0.251 (0.040, 1.570) 0.139 Eating prepared food after overnight storage No 199 (94.3) 37 (15.7) 1 0.69 (0.369, 1.278) 0.236 Yes 139 (73.2) 51 (26.8) -0.16 (-0.10, 0.07) 1 1 Cleanness of water storage area No 139 (67.5) 67 (32.5) 0.23 (0.16, 0.31) 1 1 Yes 199 (90.5) 21 (9.5) 1 2.06 (0.854, 4.956) 0.018 Water storage material being covered No 49 (55.7) 39 (44.3) 0.30 (0.18, 0.41) 2.35 (1.183, 4.662) 0.015* Yes 289 (85.5) 49 (14.5) 1 1 1 1	Fully vaccinated	273 (82 5)	58 (17 5)	1	1	
Put in toilet 254 (79.6) 65 (20.4) 1 1 Put in toilet 254 (79.6) 65 (20.4) 1 1 Child use toilet/latrine 56 (84.8) 10 (15.2) -0.05 (-0.15, 0.05) 0.667 (0.239, 1.860) 0.439 Thrown into garbage 7 (43.8) 9 (56.2) 0.36 (0.11, 0.61) 5.05 (1.094, 23.324) 0.038* Others 21 (84.0) 4 (16.0) -0.04 (-0.20, 0.11) 0.251 (0.040, 1.570) 0.139 Eating prepared food after ovenight storage 0.16 (-0.10, 0.07) 1 0.69 (0.369, 1.278) 0.236 Yes 139 (67.5) 67 (32.5) 0.23 (0.16, 0.31) 1 1 1 0.49 Yes 139 (67.5) 67 (32.5) 0.23 (0.16, 0.31) 1 1 0.108 Vater storage material being covered 0.105 0.11 1 1 1 0.108 Vater storage material being covered 0.015 0.18 0.15	Child stool disposal	210 (02.0)	00 (1110)		·	
Child use toilet/latrine 56 (84.8) 10 (15.2) -0.05 (-0.15, 0.05) 0.667 (0.239, 1.860) 0.439 Thrown into garbage 7 (43.8) 9 (56.2) 0.36 (0.11, 0.61) 5.05 (1.094, 23.324) 0.038* Others 21 (84.0) 4 (16.0) -0.04 (-0.20, 0.11) 0.251 (0.040, 1.570) 0.139 Eating prepared food after ovemight storage No 199 (84.3) 37 (15.7) 1 0.69 (0.369, 1.278) 0.236 Yes 139 (73.2) 51 (26.8) -0.16 (-0.10, 0.07) 1 Cleanness of water storage area No 139 (67.5) 67 (32.5) 0.23 (0.16, 0.31) 1 No Yes 199 (90.5) 21 (9.5) 1 2.06 (0.854, 4.956) 0.108 Water storage material being covered No 49 (55.7) 39 (44.3) 0.30 (0.18, 0.41) 2.35 (1.183, 4.662) 0.015* Yes 289 (85.5) 49 (14.5) 1 1 1 1 Cleanness of food preparation area No 174 (69.3) 77 (30.7) 0.24 (0.18, 0.31) 1.76 (0.650, 4.777) 0.266 Yes	Put in toilet	254 (79.6)	65 (20.4)	1	1	
Thrown into garbage 7 (43.8) 9 (56.2) 0.36 (0.11, 0.61) 5.05 (1.094, 23.324) 0.038* Others 21 (84.0) 4 (16.0) -0.04 (-0.20, 0.11) 0.251 (0.040, 1.570) 0.139 Eating prepared food after ovenight storage	Child use toilet/latrine	56 (84.8)	10 (15.2)	-0.05 (-0.15, 0.05)	0.667 (0.239, 1.860)	0.439
Others 21 (84.0) 4 (16.0) -0.04 (-0.20, 0.11) 0.251 (0.040, 1.570) 0.139 Eating prepared food after overnight storage 0 1.99 (84.3) 37 (15.7) 1 0.69 (0.369, 1.278) 0.236 Yes 1.39 (73.2) 51 (26.8) -0.16 (-0.10, 0.07) 1 0.236 Cleanness of water storage area	Thrown into garbage	7 (43.8)	9 (56.2)	0.36 (0.11, 0.61)	5.05 (1.094, 23.324)	0.038*
Eating prepared food after overlight storage (100)<	Others	21 (84.0)	4 (16.0)	-0.04 (-0.20, 0.11)	0.251 (0.040, 1.570)	0.139
No 199 (84.3) 37 (15.7) 1 0.69 (0.369, 1.278) 0.236 Yes 139 (73.2) 51 (26.8) -0.16 (-0.10, 0.07) 1 1 Cleanness of water storage area	Eating prepared food after overni	aht storage	()			
Yes139 (73.2)51 (26.8) $-0.16 (-0.10, 0.07)$ 1Cleanness of water storage areaNo139 (67.5)67 (32.5)0.23 (0.16, 0.31)1Yes199 (90.5)21 (9.5)12.06 (0.854, 4.956)0.108Water storage material being coveredNo49 (55.7)39 (44.3)0.30 (0.18, 0.41)2.35 (1.183, 4.662) 0.015^* Yes289 (85.5)49 (14.5)111Cleanness of food preparation areaNo174 (69.3)77 (30.7)0.24 (0.18, 0.31)1.76 (0.650, 4.777)0.266Yes164 (93.7)11 (6.3)1111Flies in food preparation areaNo278 (82.5)59 (17.5)111No278 (82.5)59 (17.5)11111Yes60 (67.4)29 (32.6)0.15 (0.05, 0.26)2.24 (1.054, 4.779) 0.036^* Feces outside toiletNo296 (83.9)57 (16.1)111No296 (83.9)57 (16.1)1111Yes42 (57.5)31 (42.5)0.26 (0.14, 0.38)2.13 (0.970, 4.691)0.059Flies around a toiletNo246 (87.5)35 (12.5)111No246 (87.5)35 (36.6)0.24 (0.15, 0.33)1.59 (0.806, 3.159)0.180	No	199 (84.3)	37 (15.7)	1	0.69 (0.369, 1.278)	0.236
Cleanness of water storage area No 139 (67.5) 67 (32.5) 0.23 (0.16, 0.31) 1 Yes 199 (90.5) 21 (9.5) 1 2.06 (0.854, 4.956) 0.108 Water storage material being covered 1 2.35 (1.183, 4.662) 0.015* No 49 (55.7) 39 (44.3) 0.30 (0.18, 0.41) 2.35 (1.183, 4.662) 0.015* Yes 289 (85.5) 49 (14.5) 1 1 1 Cleanness of food preparation area 1 1 1 No 174 (69.3) 77 (30.7) 0.24 (0.18, 0.31) 1.76 (0.650, 4.777) 0.266 Yes 164 (93.7) 11 (6.3) 1 1 1 1 No 278 (82.5) 59 (17.5) 1	Yes	139 (73.2)	51 (26.8)	-0.16 (-0.10, 0.07)	1	
No 139 (67.5) 67 (32.5) 0.23 (0.16, 0.31) 1 Yes 199 (90.5) 21 (9.5) 1 2.06 (0.854, 4.956) 0.108 Water storage material being covered	Cleanness of water storage area		()			
Yes 199 (90.5) 21 (9.5) 1 2.06 (0.854, 4.956) 0.108 Water storage material being covered No 49 (55.7) 39 (44.3) 0.30 (0.18, 0.41) 2.35 (1.183, 4.662) 0.015* Yes 289 (85.5) 49 (14.5) 1 1 1 Cleanness of food preparation area 1 1 0.266 (0.650, 4.777) 0.266 (0.740, 0.31) 1.76 (0.650, 4.777) 0.266 (0.740, 0.777) 0.266 (0.740, 0.777) 0.266 (0.740, 0.777) 0.266 (0.740, 0.777) 0.266 (0.740, 0.777) 0.266 (0.740, 0.777) 0.266 (0.740, 0.777) 0.266 (0.740, 0.777) 0.266 (0.750, 0.260) 2.24 (1.054, 4.779) 0.036* Feces outside toilet 1	No	139 (67.5)	67 (32.5)	0.23 (0.16, 0.31)	1	
Water storage material being covered No 49 (55.7) 39 (44.3) 0.30 (0.18, 0.41) 2.35 (1.183, 4.62) 0.015* Yes 289 (85.5) 49 (14.5) 1 1 1 1 Cleanness of food preparation area No 174 (69.3) 77 (30.7) 0.24 (0.18, 0.31) 1.76 (0.650, 4.777) 0.266 Yes 164 (93.7) 11 (6.3) 1 1 1 1 Flies in food preparation area No 278 (82.5) 59 (17.5) 1 1 1 0.036* Yes 60 (67.4) 29 (32.6) 0.15 (0.05, 0.26) 2.24 (1.054, 4.779) 0.036* Feces outside toilet No 278 (82.5) 57 (16.1) 1 1 1 0.036* Feces outside toilet No 296 (83.9) 57 (16.1) 1 1 0.059 Flies around a toilet No 296 (87.5) 31 (42.5) 0.26 (0.14, 0.38) 2.13 (0.970, 4.691) 0.059 Flies around a toilet No 246 (87.5) 35 (12.5) 1 1	Yes	199 (90.5)	21 (9.5)	1	2.06 (0.854, 4.956)	0.108
No 49 (55.7) 39 (44.3) 0.30 (0.18, 0.41) 2.35 (1.183, 4.62) 0.015* Yes 289 (85.5) 49 (14.5) 1 1 1 Cleanness of food preparation area 1 1 1 No 174 (69.3) 77 (30.7) 0.24 (0.18, 0.31) 1.76 (0.650, 4.777) 0.266 Yes 164 (93.7) 11 (6.3) 1 1 1 Flies in food preparation area 1 1 1 Yes 60 (67.4) 29 (32.6) 0.15 (0.05, 0.26) 2.24 (1.054, 4.779) 0.036* Feces outside toilet 1 1 1 1 No 296 (83.9) 57 (16.1) 1 1 1 0.036* Feces outside toilet 92 (63.6) 0.26 (0.14, 0.38) 2.13 (0.970, 4.691) 0.059 Flies around a toilet 1 1 1 1 No 246 (87.5) 35 (12.5) 1 1	Water storage material being cov	rered				
Yes 289 (85.5) 49 (14.5) 1 1 Cleanness of food preparation area No 174 (69.3) 77 (30.7) 0.24 (0.18, 0.31) 1.76 (0.650, 4.777) 0.266 Yes 164 (93.7) 11 (6.3) 1 1 1 Flies in food preparation area 1 1 1 1 No 278 (82.5) 59 (17.5) 1 1 1 1 Flies in food preparation area 7 90.036* 1	No	49 (55.7)	39 (44.3)	0.30 (0.18, 0.41)	2.35 (1.183, 4.662)	0.015*
Cleanness of food preparation area Vo 174 (69.3) 77 (30.7) 0.24 (0.18, 0.31) 1.76 (0.650, 4.777) 0.266 Yes 164 (93.7) 11 (6.3) 1 1 1 1 Flies in food preparation area 1 1 1 1 No 278 (82.5) 59 (17.5) 1 1 1 1 Yes 60 (67.4) 29 (32.6) 0.15 (0.05, 0.26) 2.24 (1.054, 4.779) 0.036* Feces outside toilet 1 1 1 1 No 296 (83.9) 57 (16.1) 1 1 1 0.036* Feces outside toilet 1 1 0.036* 1 <td>Yes</td> <td>289 (85.5)</td> <td>49 (14.5)</td> <td>1</td> <td>1</td> <td></td>	Yes	289 (85.5)	49 (14.5)	1	1	
No 174 (69.3) 77 (30.7) 0.24 (0.18, 0.31) 1.76 (0.650, 4.777) 0.266 Yes 164 (93.7) 11 (6.3) 1 1 1 Flies in food preparation area 1 1 1 No 278 (82.5) 59 (17.5) 1 1 1 1 Yes 60 (67.4) 29 (32.6) 0.15 (0.05, 0.26) 2.24 (1.054, 4.779) 0.036* Feces outside toilet 1 1 1 0.036* No 296 (83.9) 57 (16.1) 1 1 1 0.036* Feces outside toilet 0.26 (0.14, 0.38) 2.13 (0.970, 4.691) 0.059 Flies around a toilet 0.26 (0.14, 0.38) 2.13 (0.970, 4.691) 0.059 Flies around a toilet 1 1 1 No 246 (87.5) 35 (12.5) 1 1 1 Yes 92 (63.4) 53 (36.6) 0.24 (0.15, 0.33) 1.59 (0.806, 3.159)	Cleanness of food preparation and	ea				
Yes 164 (93.7) 11 (6.3) 1 1 Flies in food preparation area No 278 (82.5) 59 (17.5) 1 1 Yes 60 (67.4) 29 (32.6) 0.15 (0.05, 0.26) 2.24 (1.054, 4.779) 0.036* Feces outside toillet No 296 (83.9) 57 (16.1) 1 1 1 Yes 42 (57.5) 31 (42.5) 0.26 (0.14, 0.38) 2.13 (0.970, 4.691) 0.059 Flies around a toilet No 246 (87.5) 35 (12.5) 1 1 1 No 246 (87.5) 35 (12.5) 1 1 0.059 Flies around a toilet Yes 92 (63.4) 53 (36.6) 0.24 (0.15, 0.33) 1.59 (0.806, 3.159) 0.180	No	174 (69.3)	77 (30.7)	0.24 (0.18, 0.31)	1.76 (0.650, 4.777)	0.266
Flies in food preparation area No 278 (82.5) 59 (17.5) 1 1 Yes 60 (67.4) 29 (32.6) 0.15 (0.05, 0.26) 2.24 (1.054, 4.779) 0.036* Feces outside toilet No 296 (83.9) 57 (16.1) 1 1 Yes 42 (57.5) 31 (42.5) 0.26 (0.14, 0.38) 2.13 (0.970, 4.691) 0.059 Flies around a toilet No 246 (87.5) 35 (12.5) 1 1 Yes 92 (63.4) 53 (36.6) 0.24 (0.15, 0.33) 1.59 (0.806, 3.159) 0.180	Yes	164 (93.7)	11 (6.3)	1	1	
No 278 (82.5) 59 (17.5) 1 1 Yes 60 (67.4) 29 (32.6) 0.15 (0.05, 0.26) 2.24 (1.054, 4.779) 0.036* Feces outside toilet 0.036* <td< td=""><td>Flies in food preparation area</td><td></td><td></td><td></td><td></td><td></td></td<>	Flies in food preparation area					
Yes 60 (67.4) 29 (32.6) 0.15 (0.05, 0.26) 2.24 (1.054, 4.779) 0.036* Feces outside toilet No 296 (83.9) 57 (16.1) 1 1 1 Yes 42 (57.5) 31 (42.5) 0.26 (0.14, 0.38) 2.13 (0.970, 4.691) 0.059 Flies around a toilet No 246 (87.5) 35 (12.5) 1 1 Yes 92 (63.4) 53 (36.6) 0.24 (0.15, 0.33) 1.59 (0.806, 3.159) 0.180	No	278 (82.5)	59 (17.5)	1	1	
No 296 (83.9) 57 (16.1) 1 1 Yes 42 (57.5) 31 (42.5) 0.26 (0.14, 0.38) 2.13 (0.970, 4.691) 0.059 Flies around a toilet V No 246 (87.5) 35 (12.5) 1 1 Yes 92 (63.4) 53 (36.6) 0.24 (0.15, 0.33) 1.59 (0.806, 3.159) 0.180	Yes	60 (67.4)	29 (32.6)	0.15 (0.05, 0.26)	2.24 (1.054, 4.779)	0.036*
No 296 (83.9) 57 (16.1) 1 1 Yes 42 (57.5) 31 (42.5) 0.26 (0.14, 0.38) 2.13 (0.970, 4.691) 0.059 Flies around a toilet Ves 246 (87.5) 35 (12.5) 1 1 Yes 92 (63.4) 53 (36.6) 0.24 (0.15, 0.33) 1.59 (0.806, 3.159) 0.180	Feces outside toilet					
Yes 42 (57.5) 31 (42.5) 0.26 (0.14, 0.38) 2.13 (0.970, 4.691) 0.059 Flies around a toilet	No	296 (83.9)	57 (16.1)	1	1	
No 246 (87.5) 35 (12.5) 1 1 Yes 92 (63.4) 53 (36.6) 0.24 (0.15, 0.33) 1.59 (0.806, 3.159) 0.180	Yes	42 (57.5)	31 (42.5)	0.26 (0.14, 0.38)	2.13 (0.970, 4.691)	0.059
No 246 (87.5) 35 (12.5) 1 1 Yes 92 (63.4) 53 (36.6) 0.24 (0.15, 0.33) 1.59 (0.806, 3.159) 0.180	Flies around a toilet					
Yes 92 (63.4) 53 (36.6) 0.24 (0.15, 0.33) 1.59 (0.806, 3.159) 0.180	No	246 (87.5)	35 (12.5)	1	1	
	Yes	92 (63.4)	53 (36.6)	0.24 (0.15, 0.33)	1.59 (0.806, 3.159)	0.180

1 = reference category, * statistically associated p-value <0.05.

environment can provide breeding sites for flies, which are known vehicles of diarrheal pathogens [44]. Inappropriate child stool disposing behavior was significantly associated with diarrhea occurrence in this study with more children having diarrhea where their mothers/caregivers throw their stool into the garbage. According to this study, the likelihood of developing diarrhea in children is 5.05 times higher if households are disposing child feces into the garbage as compared to households using latrines for disposal. The finding is consistent with a case-control study conducted in Ethiopia [45]. A study in Burkina Faso also reported that regular disposal of child stool in the latrines had an approximate 40% reduction in the diarrhea rate [46].

Diarrhea can be reduced significantly if water quality can be ensured up to the point of consumption. The risk of water contamination is high if the storage materials are not covered and it poses a greater risk of diarrhea. A significant association between diarrhea in under-five children and the habit of not covering drinking water storage material was revealed in this study. Children living in households where water was stored without cover were 2.35 times more likely to acquire diarrhea than their counterparts. This is consistent with the WHO report that showed the effective and consistent application of household water treatment and safe storage can reduce diarrheal diseases by between 28% and 45%, depending on the type of water supply [47].

One of the limitations of the current study is the inability to assess the nutritional status of children and the inability to establish a causal link between diarrhea and independent predictors due to the cross-sectional nature of the study design. In addition, the pattern of diarrhea cases in different seasons was not studied. Furthermore, because the respondents self-reported the occurrence of diarrhea and several behavioral habits like hand washing habits, they may have introduced bias into the estimates.

In conclusion, the prevalence of childhood diarrhea is high in the study area. Mothers/caregivers' being merchants, children's partial immunization status, throwing away a child's stool into the garbage, not covering water storage materials, and the presence of flies in the food preparation area were all independent predictors of diarrhea. Therefore, targeting identified risk factors with special attention is useful to reduce the occurrence of diarrhea in under-five children. Besides, further studies using qualitative methods are needed to explore local and cultural beliefs and practices of mothers/caregivers. It may provide a better understanding of the nature of epidemiology of under-five diarrhea.

DATA AVAILABILITY STATEMENT

Data will be available from the corresponding author upon a reasonable request.

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ETHICS STATEMENT

This work has been approved by the Institutional Review Board of Welkite University. Permission to conduct the research was obtained from Welkite Town Health Office. Verbal assent was obtained from mothers/caregivers of under-five children after explaining the purpose and procedure of the study before initiating the data collection process. Confidentiality was maintained at all levels of the study.

AUTHOR CONTRIBUTIONS

DW and TE conceived the study idea and DW coordinated field data collection. DW, GT, KK, GM, and TE were involved in design of the study, data analysis and preparation of the manuscript. DW drafted the manuscript. All authors have revised and approved the final manuscript.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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