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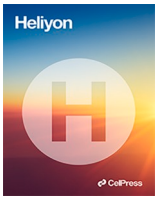

Research article

To do's after war: Priorities for acute diarrheal diseases intervention among under-five children in conflict settings of Raya Kobo district, Northeastern Ethiopia

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ABSTRACT

Introduction: Diarrheal diseases are significant causes of under-five children mortality and morbidity in developing countries. This is particularly alarming among the community living in conflict zones where less attention is given for basic services including water, food, and health. However, there are no detailed investigations on acute diarrhea among under-five children in conflict-affected areas, which impedes intervention approaches. Therefore, this study was designed to assess the prevalence of acute diarrhea and associated factors among under-five children in conflict-affected setting of Raya Kobo, Northeast Ethiopia.

Methods: A community-based cross-sectional study was employed among 463 under-five children in Raya Kobo district, from February to March 2021. The study participants were selected from ten rural kebeles. Pre-tested questionnaire and observational checklist were used to collect the data. Bivariate and multivariable logistic regression analyses were computed to identify factors associated with the prevalence of acute diarrhea.

Results: The prevalence of acute diarrhea among under-five children was 21% (95% confidence interval (CI): 18.50–23.91%). Unimproved drinking water source (Adjusted odds ratio (AOR) = 2.89; 95%CI: 1.38–6.06), disposal of garbage in open field (AOR = 3.33; 95% CI:1.66–6.67), having low monthly income (AOR = 5.73; 95%CI: 3.07–10.59), absence of latrine facility (AOR = 3.18; 95%CI: 1.09–8.78), poor hand washing practice at critical times (AOR = 2.52; 95%CI:1.28–4.05), not regularly cleaning food utensil before child feeding (AOR = 2.54; 95%CI:1.31–4.94), and not received Rota vaccine (AOR = 4.28; 95%CI: 1.82–10.11) were the determinant factors.

Conclusions: To reduce the burden of acute diarrheal diseases, post-war intervention approaches should emphasize on advocating for Rota virus vaccination, regularly cleaning food utensils before feeding, improving hand washing practice at critical times, provision of improved drinking water source, and use of proper solid and domestic sewage discharge/disposal methods.

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1. Introduction

Diarrhea is defined as an abnormal increase in daily stool fluidity, frequency, and volume [1]. It is one of the global public health problems for under-five children in developing countries, particularly Africa and Asia [2]. The magnitude of acute diarrhea among under-five children is reported to be seven times higher in the African region than European region [3], with diarrhea accounting for as much as 7.7% of all deaths in Africa [4]. According to the WHO, from 370,000 global annual under-five children diarrheal deaths, more than half are from Africa [5]. Evidences from different studies indicated that the magnitude of acute diarrhea could be as high as 23.8% in Cameroon [6] and 49.3% in Nigeria [7]. For instance, in Nigeria, nearly 151,700 children die every year from diarrheal diseases [7].

In Ethiopia, diarrheal diseases remain among the top two causes of under-five children mortality and morbidity. Various studies showed that the magnitude of acute diarrhea was 31.7% in Debre Berhan referral hospital [8], 30.5% in South Ethiopia [9], 21.6% in Bahir Dar town [10], 16.7% in Northwest Ethiopia [11], 14.7% in Central Ethiopia [12], 14.6% in East Ethiopia [13], 11% in Wolaita Sodo [14], and 8.5% in Addis Ababa [15]. Evidences from these different studies indicated that water supply interruption [16], poor hand washing practice [17],[18], unimproved sanitation facility and inadequate quantity of water (for different purposes) [17], absence of hand washing facilities near latrines [19], unclean latrine [20], and absence of sanitation facility [21] were the determinant factors for the high prevalence of acute diarrhea.

Raya-Kobo district and its surroundings are conflict-inflicted areas in Ethiopia, where frequent armed inter-border conflict being a significant public health problem. Even though various interventions have been implemented in the district, diarrhea remains one of the top-ten public health concerns [22]. Particularly recently, associated with frequent armed inter-border conflict in the area, which has both historical and linguistic bases [23], no/less attention is being given for basic services including water, food, and health in the district. The destruction of basic infrastructures could increase the spread of such communicable diseases. In spite of all, there are no detailed investigations on the magnitude of acute diarrheal diseases and its determinants among under-five children in this conflict-affected area. Consequently, it is puzzling to enlighten the general community about the potential threats, and possible safety measures needed. Therefore, this study is aimed at assessing the magnitude of acute diarrhea and associated factors among under-five children in Raya Kobo district. Our findings could help suggest important directions towards the prevention and control of diarrheal disease.

2. Methods and materials

2.1. Study area

This study was done in Raya Kobo district which is located some 555 km from the capital city of Ethiopia, Addis Ababa. The district is bordered by Tigray and Afar regions in the north and east, respectively. In 2018, the total population of the district was about 261,897 [24]. There are 24 rural and 8 urban kebeles (kebele is the lowest administrative unit in Ethiopia) in the district. Regarding healthcare facility, the district has two public hospitals and 8 health centers.

2.2. Study design and period

A community-based cross-sectional study design was employed from February to March 2021.

2.3. Source and study population

Our study focuses on rural area of the district. Hence, all under-five children paired with mother/caregivers in the rural kebeles of Raya Kobo district were the source population, whereas systematically selected under-five children paired with mother/caregivers in the rural kebeles were the study population.

2.4. Inclusion and exclusion criteria

All under-five children together with their mothers/caregivers in rural kebeles of Raya Kobo district were included in the study. However, children experiencing bloody diarrhea (frequently caused by dysentery) and/or persistent diarrhea (might last longer than two weeks) were excluded.

2.5. Sample size determination

The sample size was computed using a single population proportion formula (see below) with the assumptions of 95% confidence level ($Z_{\alpha/2} = 1.96$), proportion (p) of acute diarrhea among under five children (13.7%), which was taken from a study conducted in Amhara region, Northwest Ethiopia [13] and 4% margin of error (d).

$$n = \left(Z_{\alpha/2}\right)^2 p(1\text{-}p) \Big/ d^2$$

Then, 10% non-response rate and 1.5 design effects were considered to provide a final sample size of 470.

2.6. Sampling technique and procedure

From a total of 24 rural kebeles, 10 were randomly selected using lottery method. Households having under-five children were surveyed prior to the study and the study participants were proportionally allocated to each selected kebele (Fig. 1). Systematic random sampling method was employed to select under-five children from the selected kebeles. Data was collected in every eight household interval. Where ever there are two or more children in a given household, only one of them (randomly selected) was included in the study.

2.7. Data collection and quality assurance

Structured questionnaire and observational checklist (Appendix 1), which were adapted from similar articles, were used to collect data [17,19,20,25]. The tools were first prepared in English, translated to the local language (Amharic) and then translated back to English. The independent variables include socio-economic, behavioral, and environmental factors (Appendix 1). Two days of training was given by the principal investigator to the data collectors and supervisors on the methods of data collection and objective of the study. Pre-test was conducted to ensure the validity of questionnaire among 47 under-five children in the neighborhood kebele and some amendments were made. The reliability was determined by calculating the Cronbach's alpha method, which demonstrated a satisfactory internal consistency. The Cronbach's alpha value was 0.77, which indicates sufficient reliability. Five BSc clinical nurses (data collectors) and three BSc Environmental health officers (supervisors) were recruited. Supervisors checked the completeness and consistency of the data daily. Five percent of the data was also double-entered to ensure the accuracy of the entered data. Continuous variables, such as age, were categorized into groups.

2.8. Data processing and analysis

All the collected data was coded and entered into Epi data 3.1, and exported to SPSS 25 for data cleaning and analyses. Bivariate logistic regression analysis with a cut-off point of $p < 0.25$ was performed to screen candidate variables. Then, a multivariable analysis with an adjusted odds ratio (AOR) and their 95% CI were used to measure the association between dependent and independent variables. Factors with p-value less than 0.05 were taken as statistically significant. No multi-collinearity was detected among the independent variables as the maximum standard error was 1.83. Hosmer-Lemeshow test was used to check the model fitness and $p > 0.05$ was considered.

2.9. Operational definitions

Acute diarrhea: "is defined as having three or more loose or watery stool in a 24 h period in the household during or within the two

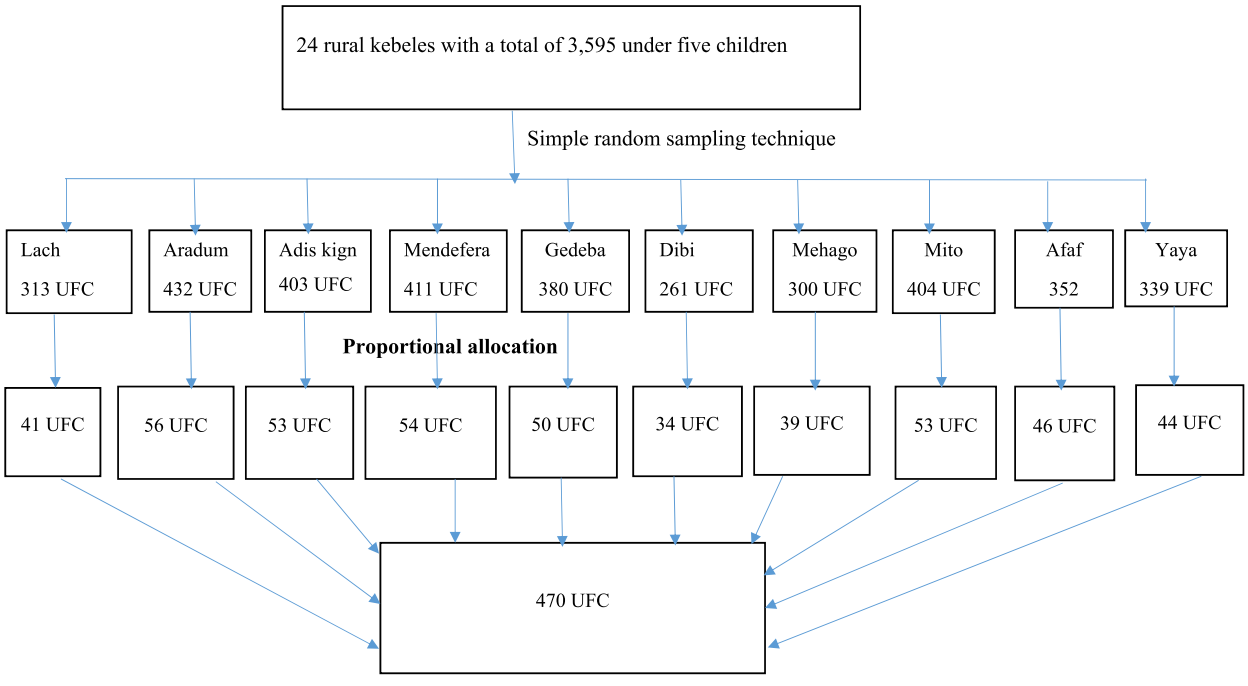

Fig. 1. Sampling procedure for assessing acute diarrhea among under-five children in conflict setting of Raya Kobo district (UFC indicates under-five children).

weeks period prior to the survey, as reported by the mother/caretaker of the child" [26]. It was reported as either yes or no.

Improved sanitation (latrine): "The Joint Monitoring Programme (JMP) for water supply and sanitation of WHO and UNICEF defines improved sanitation as flush toilets and pit latrines using the flush/pour-flush method that are connected to either a sewer or a septic system, ventilated improved pit latrines, and pit latrines with slab and composting toilet" [27].

Unimproved sanitation (latrine): "The JMP for water supply and sanitation of WHO and UNICEF defines unimproved sanitation as pit latrines without a slab, open defecation, and public, latrines. Improved sanitation facilities that are shared by two or more households are classified as unimproved because shared sanitation facilities tend to be less hygienic and less accessible than private sanitation facilities used by a single household" [27].

Unimproved water source: "Water is taken from unprotected dug wells or springs, or surface water sources; or an improved source that is more than 500 m from the premises; or there is no water source" [27].

Improved water source: Water is available from an improved source within 500 m of the premises [27].

Good hand washing practice: "Hand washing practices at least three times out of five critical times of hand washing practice" [11]. Unless, it is considered poor hand washing practice.

Hand washing at critical time: washing hand with soap and water after using toilet, after changing infant diaper, before prepare food, before eating food and before breastfeeding [11].

3. Results

3.1. Socio-demographic characteristics

In this study, a total of 463 study participants have participated giving a response rate of 98.5%. From the study participants, slightly more than half (54.2%) were female. More than one-third of the children (37.4%) and mothers/caregivers (36.9%) were older than 25 months and between the age of 25–35 years (Table 1).

- "1 Ethiopian birr is equivalent to 51.5 USD" (date used for conversion - 10 October 2022)

3.2. Prevalence of acute diarrhea

In this study, the prevalence of acute diarrhea among under-five children was 21% (95% CI: 18.5–23.9%).

Table 1
Socio-demographic characteristics of the study participants (N = 463) in Raya Kobo district, Northeastern Ethiopia, 2021.

Variables	Categories	Frequency	Percentage (%)
Sex of child	Female	251	54.2
	Male	212	45.8
Age of children (months)	<6	54	11.7
	6–11	87	18.8
	12–24	149	32.2
	≥25	173	37.4
Age of mothers/caregivers (year)	<25	140	30.2
	25–35	171	36.9
	≥35	152	32.8
Birth order of child	First order	109	23.5
	Second order	122	26.3
	Third order	93	21.1
	Fourth and above	139	30.0
Education of mothers/caregivers	No read and write	290	62.6
	Elementary	121	26.1
	High school	31	6.7
	Diploma and above	21	4.6
Current marital status of mothers/caregivers	Married	375	81.0
	Divorced	45	9.7
	Widowed	43	9.3
Mother or caregiver occupation	Housewife	359	77.5
	Merchant	53	11.5
	Private and government employee	51	11.0
House hold size	<5	239	51.6
	≥5	224	48.4
Family average monthly income (Ethiopian birr)	<1000	330	71.3
	1001–2000	50	10.8
	≥2001	83	17.9

3.3. Behavioral factors

More than half (52.7%) of children's mothers/caregivers had poor hand washing practice at critical times. More than one-third (41.7%) of the children had not received Rota vaccine. Two hundred seventy three (59%) of the children were breastfed. Once more, 152 (32.8%) of the children's mothers/caregivers have the experience of cleaning food utensils before feeding the child (Table 2).

4. Environmental factors

From the total respondents, 255 (55.1%) of mothers/caregivers used unimproved water source for drinking. Nearly two-thirds (271, 58.5%) of the study participants traveled more than 30 min for fetching water. Similarly, majority (77.5%) of the study participants used less than 20 L of water per capita per day. More than two-thirds of the study participants disposed solid waste into open fields (Table 3).

4.1. Factors associated with acute diarrhea

According to the results of the multivariable logistic regression analysis, source of drinking water, disposal of garbage, monthly income, availability of latrine, food utensil cleaning before child feeding, hand washing practice at critical times, and Rota vaccination were significant factors associated with acute diarrhea (Table 4). The odds of acute diarrhea were almost six times higher among the family who had a mean monthly income of less than 1000 Ethiopian birr than others (AOR = 5.73; 95%CI: 3.07–10.59). The odds of acute diarrhea were also 2.9 times higher among children who used unimproved water source than their counterparts (AOR = 2.89; 95%CI: 1.38–6.06). Once more, children who had no access to toilet facility were three times more likely to have acute diarrhea than others (AOR = 3.18; 95%CI: 1.09–8.78). The odds of acute diarrhea were 2.5 times higher among children who had families practicing poor hand washing (AOR = 2.52; 95%CI: 1.28–4.05). Moreover, children who did not receive Rota vaccine were 4.3 times more likely to have acute diarrhea than those who received Rota vaccine (AOR = 4.28; 95%CI: 1.82–10.11).

5. Discussion

The prevalence of acute diarrhea among under-five children in Raya Kobo district was 21% (95% CI: 18.5–23.9%). Our finding was higher than the previous reports in Wolayta Sodo (11%) [14], Debre Berhan (12.2%) [8], Ethiopian Demographic health survey report (2016) (12.2%) [12], East Gojjam (13.5%) [25], Jigjiga town (14.6%) [13] and Farta district (18.0%) [11]. The high prevalence in Raya Kobo might probably be linked with the influence of frequent conflict and instability. During the study period, the infrastructure including healthcare system, water supply system, and sanitation facility, in our study area were heavily damaged and were almost non-functional which enhance the prevalence of diarrhea. This concept is also supported by a study done in Afghanistan [28].

Indeed, the prevalence reported in our study is comparable with study reports from non-conflict settings in Western Ethiopia (21.8%) [29], North Gondar (22.1%) [30], and Northwest Ethiopia (22.1%) [31]. It is strongly believed that although a war zone, the implementation of health extension package programs in Raya Kobo district prior-to the war might have contributed to the reduction in the burden of acute diarrheal diseases as indicated by Desta and Basha [32].

The type of drinking water source was identified as an important predictor for the prevalence of acute diarrhea. The odds of acute diarrhea were 2.9 times higher among children who used unimproved water source than their counterparts. This is associated with the fact that unprotected water sources are liable to human and animal waste contamination, which could contain a variety of disease-causing pathogenic organisms [33] This association was also supported by studies conducted in Benishangul-Gumuz Region [33], Southern Ethiopia [34], Northwestern Ethiopia [35], and Northeastern Ethiopia [36].

Children living with mothers/caregivers who dispose garbage in open field were approximately three times more likely to have

Table 2
Behavior of mothers/caregivers and children (N = 463) related to acute diarrhea in Raya Kobo district, Northeastern.

Variables	Categories	Frequency	Percentage (%)
Mothers/caregivers hand washing practice at critical times	Good	219	47.3
	Poor	244	52.7
How long did the child fed with breast (months)	<24	259	55.9
	≥24	204	44.1
Complementary food starting time	<6 months	149	32.2
	≥6 months	314	67.8
Clean child food utensil before feeding	Yes	311	67.2
	No	152	32.8
Received Rota vaccine	Yes	270	58.3
	No	193	41.7
Received vitamin A vaccine	Yes	320	69.1
	No	143	30.9
Received measles vaccine	Yes	260	56.1
	No	203	43.9

Table 3
Environmental factors related to acute diarrhea (N = 463) in Raya Kobo district, Northeastern.

Variables	Categories	Frequency	Percentage (%)
Source of drinking water	Improved	208	44.9
	Unimproved	255	55.1
Type of water storage container	Pot and/or bucket	328	70.8
	Jerrycan	135	29.2
Water used per capita per day	<20	359	77.5
	≥20	104	22.5
Household water treatment	Yes	218	47.1
	No	245	52.9
Presence of latrine facility in the household	Yes	215	46.4
	No	248	53.6
Type of latrine facility (n = 215)	Improved	54	25.1
	Unimproved	161	74.9
Ownership of latrine (n = 215)	Private	164	76.3
	Shared	51	23.7
Faces around the pit hole/slab/floor of the latrine (n = 215)	Yes	112	52.1
	No	103	47.9
Presence of hand washing facility near to the latrine (n = 215)	Yes	81	37.7
	No	134	62.3
Disposal of liquid waste	Pit	138	29.8
	Open field	325	70.2
Disposal of solid waste	Pit	151	32.6
	Open field	312	67.4
Proximity of latrine from home (meter) (n = 215)	<15	193	89.8
	≥15	22	10.2

Table 4
Multivariable analysis of factors associated with acute diarrhea among under-five children in Raya Kobo district, Northeastern Ethiopia, 2021.

Variables	Category	Acute diarrhea		COR (95% CI)	AOR (95% CI)
		Yes	No		
Family average monthly income	<1000	43	291	4.81(2.82–9.19)	5.73(3.07–10.59) ***
	1000–2000	17	32	2.14(1.48–3.09)	1.35 (0.59–3.05)
	>2001	29	51	1	1
Source of drinking water	Unimproved	65	192	1.86(1.18–3.01)	2.89(1.38–6.06) **
	Improved	32	176	1	1
Presence of latrine facility	No	56	192	1.23 (1.09–1.94)	3.18(1.09–8.78) *
	Yes	41	174	1	1
Disposal of garbage	Open field	84	241	3.35(2.37–8.93)	3.33(1.66–6.67) ***
	Pit	13	125	1	1
Mothers/caregivers hand washing practice at critical times	Poor	64	180	2.00(1.27–3.23)	2.52(1.28–4.05)* **
	Good	33	186	1	1
Clean child food utensil before feeding	No	54	98	3.43(2.15–5.82)	2.54 (1.31–4.94)* *
	Yes	43	268	1	1
Child received Rota vaccination	No	62	141	2.86(1.12–3.25)	4.28 (1.82–10.11) ***
	Yes	35	225	1	1

1 = Reference group, * Significant at p-value <0.05, ** p-value <0.01, *** p-value <0.001.

acute diarrhea than others. This finding is in agreement with reports from Southwestern Ethiopia [37] and Eastern Ethiopia [38]. Similarly, latrine facilities are significant factors associated with acute diarrhea. The chances of acute diarrhea were three times higher among children who had no latrine facility than those who had it, which is similar with the findings reported in Derashe town [34], Amhara region [25], and Ghana [39]. This implies that unavailability of latrine and disposal of garbage into uncontrolled open environment could contaminate the environment and thereby increase the spread of diarrheal diseases.

Children whose mothers/caregivers were practicing poor hand washing at critical times were 2.5 times more likely to experience acute diarrhea than their counterparts. This finding was consistent with the previous studies conducted in Debre Berhan town [8], Addis Ababa [15], Northeastern Ethiopia [17], Western Ethiopia [19], and Gaza strip [40].

The magnitude of acute diarrhea was also related with the use of unclean food utensil for feeding children. Not regularly cleaning food utensils before child feeding could expose children to microorganisms and hence increase the odds of acute diarrhea. Moreover, the likelihood of acute diarrhea was 4.28 times higher among those who did not receive Rota vaccine than others. Though not in line with a study conducted in Western Ethiopia [19], this finding is in agreement with reports from South [41] and Southwest Ethiopia [29]. This is due to the fact that being vaccinate against Rota virus could reduce the possibility of experiencing acute diarrhea [11].

6. Limitations of the study

Due to shortage of literature on acute diarrhea among under-five children in conflict settings, our discussion was mainly made on the basis of findings from non-conflict areas. In addition, this cross-sectional study might not establish cause-effect relationship between diarrhea and predictor variables. As medical reports were not checked, there is also a potential social-desirability bias.

7. Conclusions

The two-week prevalence of acute diarrhea was 21%. In order to tackle the problem, post-war intervention approaches should emphasize on advocating for Rota virus vaccination, regularly cleaning food utensils before feeding children, improving hand washing practice at critical times, provision of improved drinking water source, and implementing proper waste management strategies.

Author contribution

This study was performed in collaboration among all the authors. All authors have made substantial contributions to conception and design, acquisition of data, analysis, and interpretation of data; took part in drafting the article and revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agreed to be accountable for all aspects of the work.

Funding statement

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Ethical approval

The study complies with the declaration of Helsinki. All procedures, including ethical approval and research permission, were performed in accordance with national standards, guaranteeing the anonymity of the respondents. The study was approved by the institutional review board of the Wollo University, College of Medicine and Health Sciences (Approval number: CMHS 1257/2012). Besides, ethical approval was also taken from Raya Kobo district administration. Informed consent for participation was received from the families/kin of the children.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Abbreviations

AOR	Adjust Odds Ratio
COR	Crude Odds Ratio
CL	Confidence Interval
WHO	World Health Organization

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e28394.

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