Determinants of Under-Five Childhood Diarrhea in Kotebe Health Center, Yeka Sub City, Addis Ababa, Ethiopia: A Case Control Study

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Abstract- Background: It is a fact that diarrheal diseases caused major public health problem in children under-five years of age, especially in developing countries like Ethiopia. The objective of this study was to investigate the association of socio demographic, behavioral and environmental factors with under five diarrhea in Kotebe area, Yeka sub city, Addis Ababa.

Methods: Institutional based unmatched case-control study design was conducted. A case in this study was a child under-five years of age visited Kotebe health center for treatment and a control was a child under-five years of age without diarrhea that came to the center for vaccination and treatment of other cases. A face-to-face interview based on a pre-tested, structured questionnaire was conducted with mothers/ caretakers with trained nurses.

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DETERMINANTSOFUNDER-FIVECHILDHOODDIARRHEAINKOTEBEHEALTHCENTERYEKASUBCITYADDISABABAETHIOPIAACASECONTROLSTUDY

Strictly as per the compliance and regulations of:

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Result: A total of 350 study subjects, including 117 cases and 233 controls, were recruited into the study. The study revealed that some factors remained independently associated with the risk of diarrhea, namely age of the children AOR (95%CI); 4.22 (1.36-13.14), maternal education AOR (95%CI); 0.33 (0.16-0.65), supplementary feeding commencing time AOR (95%CI); 0.30 (0.09-0.95) and hand washing after cleaning child bottom AOR (95%CI); 0.59 (0.35-0.99) with p-value ≤ 0.05.

Conclusion: From this study, associated factors of diarrhea were identified. The finding is important for health intervention and supports the view that investing in girls' education has substantial benefits on child health.

Keywords: unmatched case-control, under-five childhood diarrhea, yeka sub city, kotebe health center, addis ababa.

I. Introduction

Diarrhea is a global problem, but is especially prevalent in developing countries in conditions of poor environmental sanitation, inadequate water supplies, poverty and limited education (1). In developing countries, approximately 2 million people, the vast majority of whom are under-five children, die from diarrhea each year (2). The Iraq study showed that diarrhea was associated with age of child, area of residence, maternal education, a source of water, toilet (3). Demographic and socioeconomic factors, including age of the child, religion, ethnicity, level of education, marital status, and number of children, mother's job and income of the family. The positive correlation between maternal education and child health outcomes is well established. One study in Bangladesh showed that a child whose mother completed primary school is 20% more likely to survive than a child whose mother has not received any formal schooling, and a child born to a mother who attended secondary school is 80% more likely to survive (4). Environmental determinant factors include a source of water, water treatment, latrine availability, latrine ownership, waste water disposal, refuse disposal, separate house for domestic, and adult member defecation. Diarrheal disease due to unsafe water and lack of sanitation are the biggest cause of morbidity and mortality in under-five children in the world especially in poor countries (5). A child dies every 15 seconds from diarrhea caused largely by poor sanitation and contaminated water supply (6). Behavioral factors of diarrhea include hand washing time, hand washing habit, supplementary feeding time, method of feeding, and measles immunization. Behavioral factors associated with acute childhood diarrhea include lack of hand-washing, poor infant and young child feeding practices and lack of child immunizations (7). Therefore, the objective of this study was to assess diarrheal associated socio demographic, environmental and behavioral determinants of acute childhood diarrhea factors among children aged under five years.

II. Methods

Institutional unmatched case-control design was used to assess the determinants of under five diarrhea from February to March 2014 in Kotebe health center, Yeka sub city, Addis Ababa. The population of Yeka is the largest of all sub cities in Addis Ababa which is 346,484. The proportion of under-five children in the Yeka sub city is 5.4%. Diarrhea prevalence is 9.4% in Addis Ababa (8).

The source population was under-five children attending at Kotebe health center. Study population

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includes selected children less than five years of age who visited Kotebe health center. Study units were samples of under five children with diarrhea for cases and without diarrhea for controls who visited Kotebe health center.

The sample size calculation was based on the following assumptions: P1=proportion of diseased with disposal of refuse in the pit; P2= proportion of non-diseased with disposal of refuse in the pit. From a similar study conducted in Nekemte town with refuse disposal method as the main predictor of outcome (diarrhea), the sample was 42.86% of cases and 61.47% of the control (9). *Therefore, P1=0. 4286, z1=1. 96 (95% CI) and P2=0. 6147, z2=0. 84 (power of 85%) the proportion of case and control was assumed to be 1:2.* Ten percent non-response rate, the total sample was estimated using Epi Enfo ™ 7.1.0.6 software as 350 (Cases=117, Control=233).

A structured questionnaire was developed to collect information on socio demographic and economic characteristics, environmental conditions and behavioral aspects for both cases and controls. Since the children were too young at under five years of age to be interviewed, verbal consent was taken from the mothers or caregivers.

Diarrheal children less than five years of age visited Kotebe health center were recruited into the study after their parents expressed the willingness to participate in the study. To ensure that cases selected for the study represented a homogeneous entity, a definition of diarrhea was established. In addition, the age of a child was verified by cross-examining the information provided on their health and vaccination cards, or by the confirmation of the mother.

In this study, non-diarrheal patient children and those who came for vaccination with the age of less than five years admitted to Kotebe health center between February to March 2014 were selected into the study. The recruitment of controls was carried out after their parents consented to participate in the study. Finally, like cases, the parents were more likely to be willing to cooperate than the parents of healthy children, thus minimizing bias due to non response.

The questionnaire was developed after reviewing relevant literatures to the subject to include all the possible variables that address the objective of the study. The questionnaire was first prepared in English and then translated to Amharic and back translated to English to maintain the consistency of the contents of the instrument. Data collectors were trained and closely supervised during data collection. The training mainly focused on interviewing techniques. Frequent communication between the research team was conducted.

The pre-testing of the questionnaires was conducted on five percent of the questionnaires before data collection. After conducting pre-testing, some change in the questionnaire was made. On the measles

vaccination status of children, in some cases mothers could not remember exactly whether children had vaccinated or not. Therefore, for example, mothers were asked whether (or not) their children had been vaccinated on the ninth month (ninth month vaccination). The completed questionnaires were checked every day during data collection for completeness, clarity and consistency.

In the study, the occurrence of diarrhea in a child was considered to be the dependent/outcome variable. Environmental factors (a type of water source, availability and ownership of toilet facility, solid and liquid waste disposal method), socio demographic (age, sex, religion, ethnicity, family size, educational status, and maternal job) and behavioral factors (hand washing, supplementary feeding commenced, and measles immunization) as exposure/independent variables.

The data were entered and analyzed using SPSS version 20. Descriptive statistics (frequencies, proportion, measures of central tendencies and variations were obtained and displayed mainly on the tables and word expressions) were used to describe the study population in relation to relevant variables. The odds ratio was computed to see the strength of association. To identify independent predictors of childhood diarrhea, only variables that were statistically significant during bivariate test were entered into multiple logistic regression models to control the effect of confounders. P≤0. 05 was considered statistically significant. Results were reported as the adjusted odds ratio (AOR) and 95% confidence intervals.

The necessary ethical consideration was made before the actual data collection took place. Written consent was obtained from the ethical clearance committee of Debre Markos University medicine and the health Sciences College. Written Ethical approval and letter of permission were obtained from the concerned bodies of Addis Ababa city health bureau, sub city health office, and woreda health office officials. Before each interview, participants were provided with an explanation of the purpose of the study and its procedures. Participation (which includes mothers/caretakers) in the study was totally voluntary. They were not forced or persuaded to participate in the study. Informed verbal consent was obtained from the mothers/caretakers of the children. Privacy and confidentiality were maintained during the interview. Since the study was conducted by asking mothers of children recruited to gather information, the conduct of the study did not pose any health risk to the participants. Mothers who were found that their children were sick during the study time were consulted about the causes of the disease and her knowledge about it.

III.   Results

A total of three hundred and fifty respondents was included in the study with a response rate of 100%. Of the total children, 184 (52.57%) were female. There were 55 (47%) case male and 62 (53.0%) case female. Cases were mostly children between 6 and 11 months (41%). One hundred and twenty nine (36.9%) under five children were within 12-24 months age category.

More than half of respondents 182 (52.0%) had 2-3 family size. The majority of the respondents (mothers or caregivers) 265 (75.71%) were Orthodox Christian by religion and Amhara 199 (56.86%) by ethnic group.

One hundred and thirty eight (39.4 %) mothers had secondary education and 225 (64.29%) were housewives. *Of the total cases, 32 (27.4%) fell in illiterate category and the least number of cases was found 13 (11.1%) in college/university category.*

Table 1 : Socio-demographic and economic characteristics of diarrhea among children under 5 years of age in Yeka sub city, Addis Ababa, 2014 (n=350)

Variables	Category	Total	
		Frequency	%
Age of child (months)	<6	45	12.9
	6-11	115	32.9
	12-23	129	36.9
	24-59	61	17.4
Sex of child	Male	166	47.43
	Female	184	52.57
Family number	2-3	182	52
	4-6	158	45.14
	7-10	10	2.86
Religion	Orthodox	265	75.71
	Muslim	39	11.14
	Protestant	46	13.14
Ethnicity	Oromo	76	21.71
	Amhara	199	56.86
	Tigrie	30	8.57
	Guragie	32	9.14
	Others	13	3.71
Maternal education	Illiterate	81	23.0
	Able to read and write	27	7.70
	Primary (1-8)	71	20.30
	Secondary (9-12)	138	39.40
	College/University	33	9.43
Occupation of Mother	House wife	225	64.29
	Daily laborer	20	5.71
	Farmers	3	0.86
	Employee	97	27.71
	Others	5	1.43
Marital status	Married	316	90.3
	Single	9	2.6
	Divorced	13	3.7
	Widowed	6	1.7
	Separated	6	1.7

The majority of respondents, 302 (86.29 %) in the area used tap as the main source of water. Only 1.43 % used unprotected well as a source of water. About 243 (69.43%) of the study population had shared latrine. Almost all respondents 349 (99.71) had latrine. Most respondents 261 (74.57%) dispose solid waste in garbage, whereas only 3 (0.86%) in open fields. More

than half of the respondents dispose liquid waste in sewage system 180 (51.58%).

Table 2 : Environmental exposure characteristics of diarrhea among children under 5 years of age in Yeka sub city, Addis Ababa, 2014. (n=350)

Variables	Category		Total	
			Frequency	(%)
Water source	Piped water		302	86.29
	Protected well/spring		43	12.29
	Unprotected well/spring		5	1.43
Latrine Owned	Private		107	30.57
	Shared		243	69.43
Latrine Availability	No		1	0.28
	Yes		349	99.71
Disposal of household/solid wastes	Open field	No	347	99.14
		Yes	3	0.86
	Pit	No	332	94.86
		Yes	18	1.84
	Burning	No	283	80.86
		Yes	67	19.14
	Garbage can	No	89	25.43
		Yes	261	74.57
Disposal of wastewater	Sewage system	No	180	51.58
		Yes	170	48.60
	Pit	No	186	53.14
		Yes	164	46.86

Out of those mothers/caretakers who started supplementary feeding for their children 70 (20.1%) started before the child reached 6 months, and 109 (31.2 %) at the age of 6 months and 134 (38.4%) mothers breastfed their children exclusively that means they started after six months. Only 36 (10.3%) did not start any supplementary food before six months.

Inconsistent with EDHS 2011 (93.5%), the majority of respondents (95.6%) explained that their children were vaccinated for measles. Only 91 (26%) of the mothers/care givers had used only water to wash their hands, whereas 341 (97.43 %) used both water and soap to wash their hands.

Table 3 : Behavioral factors for diarrhea among children under 5 years of age in Yeks sub city, Addis Ababa, 2014. (n=350)

Variables	Category		Total	
			Frequency	%
Supplementary feeding commenced	<6 (not yet started)		36	10.28
	Before 6 months		70	20
	On 6 months		109	31.20
	After 6 months		134	38.4
Measles Vaccination	No		11	4.3
	Yes		242	95.6
Hand washing substitutes	Water only	No	259	74
		Yes	91	26
	Water, Soap & substitutes	No	9	2.57
		Yes	341	97.43
	Others	No	348	99.4
		Yes	2	0.57
Hand washing time	After defecation	No	20	5.71
		Yes	330	94.29
	After cleaning child's bottom	No	167	47.71
		Yes	183	52.29

Before handling food	No	12	3.4
	Yes	338	96.6
Before feeding children	No	50	14.3
	Yes	300	85.7
Other	No	342	97.71
	Yes	8	2.29

Factors Associated with the Occurrence of Childhood Diarrhea

Table 4 presents selected socio-demographic, environmental and behavioral determinants of the mothers or care givers in relation to under-five diarrhea.

The occurrence of childhood diarrhea had association with the age of under-five children. The crude odds ratio showed that diarrhea is highest in the age group 6-11 months (COR [95% CI] =4. 66 [1.83-11.87]) and 12-23 months (COR [95% CI] =3. 73 [1.47-9.50]) and the reason for this might be, at these stages, the children could try to detect their surroundings so that they could be exposed to the case. It is least for 0-6 months of age. Comparing with illiterate, higher levels of education of mothers, such as secondary, were associated with a lower occurrence of diarrhea. In other words, OR decreased inversely in proportion to higher levels of education of mothers (COR [95% CI] = 0.37 [0.20-0.69]).

An association has been found between supplementary feeding commenced, and the occur-ence of diarrhea among under five children. The odds of the occurrence of childhood diarrhea among children who started supplementary feeding before six months was around four times [COR: 3.77, 95% CI: (1.60-9.20)] higher when compared with those less than six months and not started a supplementary food yet. An association has been found between hand washing after cleaning the child's bottom and diarrhea among under five children [COR: 0.56, 95% CI: (0.36-0.88)].

Table 4 : Factors associated with diarrhea among children under 5 years of age in Yeks sub city, Addis Ababa, 2014 (n=350)

Variables	Category	Case n (%)	Control n(%)	COR(95%CI)	AOR(95%CI)
Age of child (months)	<6	6 (5.1)	39 (16.7)	1.00	
	6-11	48 (41.0)	67 (28.8)	4.66 (1.83-11.87)*	4.22 (1.356-13.14)†
	12-23	47 (40.2)	82 (35.2)	3.73 (1.47-9.50)*	3.09 (0.97-9.88)
	24-59	16 (13.7)	45 (19.3)	2.31 (0.82-6.48)	2.45 (0.66-9.10)
Maternal education	Illiterate	32 (27.4)	49 (21)	1.00	1.00
	Able to read and write	16 (13.7)	11 (4.7)	2.22 (0.92-5.41)	1.95 (0.75-5.09)
	Primary (1-8)	29 (24.8)	42 (18)	1.06 (0.55-2.03)	0.81 (0.39-1.70)
	Secondary (9-12)	27 (23.1)	111 (47.6)	0.37 (0.20-0.69)*	0.33 (0.16-0.65)†
	College/University	13 (11.1)	20 (8.6)	0.99 (0.44-2.28)	0.87 (0.35-2.18)
Supplementary feeding commenced	<6 months (not yet started)	9 (7.7)	27 (11.6)	1.00	1.00
	Before 6 months	39 (33.3)	31 (13.4)	3.77 (1.60-9.20)*	1.16 (0.373.70)
	On 6 months	35 (29.9)	74 (31.9)	1.42 (0.60-3.34)	0.40 (0.12-1.27)
	After 6 months	34 (29.1)	100 (43.1)	1.02 (0.44-2.38)	0.30 (0.09-0.95)†
Hand washing after cleaning child's bottom	No	67 (57.3)	100 (42.9)	1.00	1.00
	Yes	50 (42.7)	133 (57.1)	0.56 (0.36-0.88)*	0.59 (0.35-0.99)†

* p < 0.05 on bivariate analysis　　　　　*† p < 0.05 on multivariate analysis*

IV. DISCUSSION

In multivariate analysis, it was found that four factors remained independently significant to the risk of diarrhea, including, age of the child [AOR: 4.22, 95% CI: (1.36-13.14)], maternal education [AOR: 0.33, 95% CI: (0.16-0.65)], supplementary feeding commenced [AOR: 0.30, 95% CI: (0.09-0.95)], and hand washing after cleaning child's bottom [AOR: 0.59, 95% CI: (0.35-0.99)] (Table 4).

The results of this study indicated that the determinants of diarrhea as age of children, maternal education, supplementary feeding, hand washing after cleaning the child's bottom which had significant association to remain in each step.

From all socio demographic variables tested, age and maternal education remained significant after controlling other variables. The analysis showed that the age of the child had a significant effect on diarrhea, which is consistent with a study in Ethiopia (10). This study observed that the cases were mostly children between 6 and 11 months of age, in which there were 48 cases, making up the highest rate (41% of the total). Number of cases decreased in older children.

In general, the study showed that diarrhea was significantly associated with children in the age groups 6 - 11 months and 12 - 23 months. This finding is in agreement with another study in Ethiopia (11) and Ghana (12). The risk of diarrhea decreases sub-subsequently after 6 - 11 months; this is probably because the children begin to develop immunity to pathogens after repeated exposure (13).

The population policy of Ethiopia seeks to significantly increase female participation at all levels of the educational system. However, only 6 percent of females completed secondary education in Addis Ababa. The regression results supported the positive role of maternal education to under five diarrhea. The odds of having diarrhea associated with mothers' education remained significant even after controlling for all other variables. Based on this analysis those children whose mothers were at the secondary level of education are less likely to get diarrhea by 33% when compared to the reference illiterate.

It was found that mothers with higher education experienced better chance of a child being free of diarrhea, which is consistent with a cross sectional study in Ethiopia (14). Maternal education was significantly associated with diarrheal in children. The study in Ghana (15) indicated that the prevalence of diarrhea was lower among children of more educated mothers (secondary or higher) than among children of mothers with no or primary education. Educated mothers practice good hygiene, better child feeding and weaning practices. One study in Bangladesh showed that a child whose mother completed secondary school is 80% more likely to survive (16). But according to another study in Ethiopia (17), educational status of mothers or care takers was not statistically significant in relation to diarrhea.

Children who were partially on breast milk were more likely to have diarrhea than children who were exclusively on breast milk (18). In this study there were 34 cases (29.1%) and 100 controls (43.1%) that started supplementary feeding after 6 months. According to multivariate analysis in table 4, it was found that there was significant association between starting a supplem-entary food lately after 6 months and diarrhea. The finding of this study showed that children who were exclusively breastfed at the time of the survey were less likely to have diarrhea compared to less than six months' children who were not started supplementary food.

The odds of developing diarrhea was 59% less among children whose mothers washed their hands after cleaning their child's bottom. Studies showed the importance of hand washing in reducing the occurrence of childhood diarrhea (19).

V. Conclusions

The results of the study showed that the factors, namely age of children, maternal education,

supplementary feeding and washing after cleaning the child's bottom were significantly associated with diarrhea among children less than five of age visiting Kotebe health center.

Overall, the finding is important for health intervention and support the view that investing in girls' education may have substantial benefits for child health. In this study, it has been found that education provides a solution. Specifically, secondary or above level of education for girls better be achieved in order to improve childhood diarrhea.

VI. Acknowledgements

References Références Referencias

1. Boschi-Pinto C, Velebit L, Shibuya K. Estimating child mortality due to diarrhoea in developing coun-tries. *Bull.* World Health Organ. 2008; 86:710–7.
2. Ahs JW, Wenjing T, Lofgren J, Forsberg BC. Diarrhoeal Diseases in Low- and Middle-Income Countries. Open Infectious Diseases Journal 2010; 4(123): 113-124.
3. Siziya S, Muula AS, Rudatsikira E. Diarrhoea and acute respiratory infections prevalence and risk factors among under-five childrenin Iraq in 2000. Ital J Pediatr. 2009;35:8.
4. Whyte H. Maintaining momentum to 2015? An impact evaluation of interventions to improve maternal and child health and nutrition in Bangladesh. World Bank, Washington, D.C.,2005, p. 25
5. Woldemicael G. Diarrheal morbidity among children in Eritrea: environmental and socio-economic determ-inants. J Health Popul Nutr; 2001; 19 (2): 83-90.
6. Barreto, M.,*et al.* Effect of city-wide sanitation programme on reduction in rate of childhood diarrhea in northeast Brazil: assessment by two cohort studies. Lancet 2007; 370: 1622–28].
7. Wondwossen B. A stepwise regression analysis on under-five diarrhael morbidity prevalence in Nekemte town, western Ethiopia: Maternal care giving and hygiene behavioral determinants. East African Journal of Public Health Volume 5 Number 3 December 2008.p 193-198.
9. Girma R, Wondwossen B, Bishaw D, Tefera B. Environmental determinants of diarrhoea among under-five children in Nekemte Town, western Ethiopia. Ethiopia Journal of Health Sciences 2007; 18(2): 39-44.

10. Muluken Dessalegn *et al.* Predictors of under-five childhood diarrhea: Mecha District, West Gojam, Ethiopia. *Ethiop. J. Health Dev* 2011; 25(3)

11. Desalegn, M., Kumie, A. and Tefera, W. (2011) Predictors of under-five childhood diarrhea: Mecha District, West Gojjam, Ethiopia. Ethiopian Journal of Health Develop- ment, **25**, 174-232.

12. Boadi, K.O. and Kuitunen, M. (2005) Childhood diar- rheal morbidity in the Accra Metropolitan Area, Ghana: Socio-economic, environmental and behavioral risk de- terminants. *Journal of Health & Population in Develop-ing Countries*. http://www.jhpdc.unc.edu/

13. Motarjemi, Y., Käferstein, F., Moy, G. and Quevedo, F. (1993) Contaminated weaning food: A major risk factor for diarrhoea and associated malnutrition. *Bulletin of the World Health Organization*, **71**, 79-92.

14. Mulugeta, T., socio-economic, environmental, and behavioral factors associated with the occurance of diarrheal disease among under five children , Meskana Mareko Woreda, souther Ethiopia, in community health. 2003, AAU: Butajira

15. Kwasi Owusu B, M.K., Childhood diarrheal morbidity in the Accra Metropolitan Area, Ghana: socio-economic, environmental and behavioral risk determinants. journal of health and population indeveloping countries, 2003.

16. Whyte H. Maintaining momentum to 2015? An impact evaluation of interventions to improve maternal and child health and nutrition in Bangladesh. World Bank, Washington, D.C., 2005, p. 25

17. Wanzahun Godana, Bezatu Mengiste. Environmental Factors Associated with Acute Diarrhea among Children Under Five Years of Age in Derashe District, Southern Ethiopia. *Science Journal of public Healh,* Vol. 1, No. 3, 2013, pp. 119-124.

18. Root GPM. Sanitation, community environment and childhood diarrhoea in rural Zimbabwe. J Health Popul Nutr. 2001; 19(2): 73-82.

19. Punyaratabandhu, P., Sangchai, R. and Vathanophas, K. (1993) Risk factors for childhood diarrhoeal diseases in an urban community, Bangkok, Thailand. *Journal of the Medical Association of Thailand*, **76**, 535-541.