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DETERMINANTS OF DIARRHOEAL DISEASES: A COMMUNITY BASED STUDY IN URBAN SOUTH WESTERN ETHIOPIA
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ABSTRACT

Objectives: **To identify the determinants and describe the extent of diarrhoeal diseases among under-five children in urban Ethiopia.**
Design: **Community based, cross-sectional study.**
Setting: **Jimma, a town in south western Ethiopia, is an urban area with multi-ethnic population. The town is divided into 20 *kebelles*. Each *kebelle* has a population of about 5000 people**
Subjects: **Six hundred and five children under the age of five years were selected by random sampling. There were 142 children with diarrhoeal diseases in selected households. All those without diarrhoea were taken as controls.**
Results: **The incidence at diarrhoeal diseases was 5.48 episodes per child per year. The incidence of persistent diarrhoea was 7.75%. About 24.5% of the acute diarrhoeal diseases (ADD) culminated to persistent diarrhoea. Well source of water, lack of complete immunization, attack of measles and acute respiratory infecions (ARI) in the previous two weeks were found to be significantly associated with occurrence of diarrhoeal disease; however, only ARI and well water were retained in the logistic regression analysis.**
Conclusion: **The incidence of diarrhoeal diseases and the progression to persistent diarrhoea are very high. Many of the socio-environmental factors did not appear as significant determinants independently. The implication of this is that in a homogenous and economically deprived society improvement in a single factor does not reduce the problem of diarrhoeal diseases. Hence, an inter-sectoral approach is recommended to control diarrhoeal diseases.**

INTRODUCTION

Diarrhoeal disease is a major cause of morbidity and mortality among children accounting for around three million deaths in developing countries. About 80% of these deaths occurred in the first two years of life. Across the globe there are an estimated 1.8 billion episodes of childhood diarrhoea annually, mostly in developing countries(1). In urban Ethiopia, the median incidence for the under two years of age is 6.5 episodes per child per year(2). The proportion of mortality associated with diarrhoea in Ethiopia is about 22.6% in the different regions with a median of 45%(3).

The introduction of oral rehydration therapy (ORT) is a break through in the reduction of mortality due to diarrhoea. However, some cases of acute diarrhoeal disease (ADD) episodes progress to persistent diarrhoea (PD) with severe consequences of malnutrition and mortality. It has been found that attempts to reduce diarrhoeal deaths with vertical programmes do not have a major impact unless integrated interventions are directed to persistent diarrhoea-malnutrition complex(4). Drugs have limited place in the reduction of illness burden due to diarrhoea. Hence, the main stay of alleviating the problem is by promotion of improvements in living standards which played major role in reducing diarrhoeal rates in Europe and North America(5) and employment of locally available preventive methods. Sileshi *et al*. have studied the determinants of diarrhoeal morbidity and they found that type and amount of water and latrine availability were not found to be risk factors for diarrhoeal morbidity(6). In Peru socio-economic status did not independently determine diarrhoeal incidence(7). In Nigeria, age of the child and type of kitchen had significant association with diarrhoea(8). It appears that determinants of diarrhoeal morbidity vary in different societies.

This study attempts to identify the determinants and describe the extent of diarrhoeal diseases among children under the age of five years in urban, south-western, Ethiopia.

MATERIALS AND METHODS

Study area: Jimma town is located about 335 Kms south west of Addis Ababa. In the town there are three *woredas* (A government administration unit of about 20,000 people) and 20 *kebelles* (An administrative unit within a *Woreda* of about 5,000 people). The population is multi-ethnic, the

Oromo constituting the majority. The literacy rate is 17% (9). Recent survey showed that 60% of the population use pit latrine, 81.1 % exercise indiscriminate waste disposal, 32.6% get piped water, 16.7% use protected spring/well and 25.8% use dual water source i.e. protected and unprotected source of water. The average use volume of water was 15.4 L/C/ day(10).

Study design: A cross-sectional community based survey of diarrhoeal morbidity and its determinants among under-five children (U5C) living in Jimma town was conducted during the months of February-March 1994.

Study population: The Study population comprised of children under the age of five years living in Jimma south western Ethiopia. The 1992 projected population of Jimma was 82,795 of which 14,905 were children under five years of age.

Sampling method: The town is divided into three *woredas* and 20 *kebelles*. All the *kebelles* and *woredas* were included in the study. The population of the *woredas* was 1:1.05:1.45. The list of the households with U5C was provided by the *kebelle* offices. The sample size was determined based on the data that the prevalence of diarrhoeal disease (DD) for Ethiopian children in U5C is 19%.

$$n = \frac{NZ^2P(1-p)}{d^2(N-1)+Z^2p(1-p)}$$

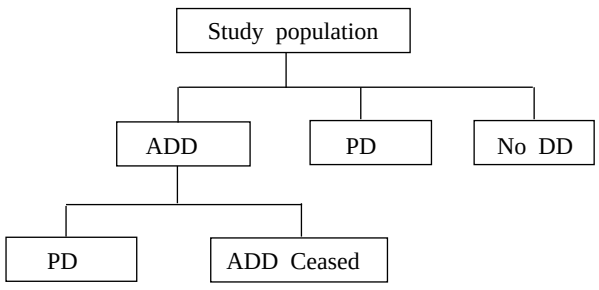
N= Total U5C in Jimma = 14,905
p= Prevalence of diarrhoea = 18%
d= Margin of error = 3%
Z = 1.96

Thus the calculated sample size was 605. This calculated sample size was divided into three *woredas* using the proportion of their U5C population. Further the allotted number of the sample for the *woreda* was divided into each *kebelle* using the U5C population proportion. The household in the *kebelles* were selected using the table of random numbers.

Data collection: Data were collected using a pre-tested, structured questionnaire by senior medical students trained for this purpose. The two-week diarrhoea recall method was used to determine the incidence rate of diarrhoea. Children who had ADD during the day of the interview were followed for the next two weeks to ascertain the culmination of ADD to PD (Figure 1).

Figure 1

Study design



Data were entered into a micro-computer using the SPSS/PC and EPI into version 5 packages(11,12). The strengths of association between socio-economic, variables and DD occurrence was estimated using the odds ratio (OR). Variables found to be potential risk factors were then taken and included into the logistic regression model. All variables were treated as categorical. The annual incidence rate from the two-week incidence was calculated. Jimma Hospital data were used to determine the "seasonality adjustment factor".

RESULTS

There was a total of 142 cases of diarrhoea among the 605 index U5C with a male to female ratio of 1:1.5 (Table 1). The peak was between 12-35 months of age. The under five calculated 2-week diarrhoea incidence rate was 26.6%, the annual incidence being 5.48 episodes per child per year. Eleven (7.8%) of the total cases had PD. Among the 126 cases of ADD on follow up 30 (23.8%) of them progressed to PD. The age and sex distribution for the total 41 cases of PD revealed a sex ratio of 1: 1.5 and the peak age was 24-35 months (Table 2).

Socio-environmental characteristics: The mean maternal and paternal ages were 29.1 (SD, 7.785) and 35.28 (SD, 13.248) years respectively. About a quarter of the mothers were illiterate and above 70% were housewives. In 36% of the households there were two or more U5C.

In 72.2% of the households there were latrines and 75.2% were observed to have proper latrine use and 63.4% practiced indiscriminate garbage disposal. In about half the source of water was pipe and just above a third get water from wells. Besides from the piped water users, about 13% of the water source were not protected. Some households (8.9%) fetch water from dual sources. Availability of latrine, latrine use and garbage disposal were associated significantly ($p<0.025$) with monthly income.

Health of the under-five children: Over 95% of the U5C had received immunization. Among those who had received immunization 87.7% had completed the immunization schedule but 9.3% did not complete the schedule. Three point two had never been immunized. In the preceding two weeks 1.5% had attacks of measles and about 20% had history of acute respiratory infections (ARI). In 27.9% the diarrhoea was watery, mucoid in 58.2% and dysenteric in 13.9%. In most cases (80.9%) the frequency was less than six times per day.

Table 1

Age and sex distibution of patients with diarrhoeal diseases

Age (months)	Male		Female		Total	
	n	(%)	n	(%)	n	(%)
0-5	3	(2.11)	1	(0.70)	4	(181)
6-11	10	(7.04)	8	(5.63)	18	(12.68)
12-23	26	(18.31)	18	(12.67)	44	(30.98)
24 -35	22	(15.49)	21	(14.78)	43	(30.28)
36-47	9	(6.34)	11	(7.75)	20	(14-09)
49-59	6	(4.23)	7	(4.93)	13	(9.15)
Total	76	(53.52)	66	(46.48)	142	(100)

Table 2

Age and sex distribution of patients with persistent diarrhoea

Age (months)	Male		Female		Total	
	n	(%)	n	(%)	n	(%)
0-5	-	-	-			
6-11	4	(18.18)	4	(21.05)	8	(19.05)
12-23	5	(22.73)	4	(21.05)	9	(21.95)
24-35	8	(36.36)	7	(36.94)	15	(36.58)
36-47	4	(18.18)	3	(15.79)	7	(17.07)
48-59	1	(4.56)	1	(5.26)	2	(4.88)
Total	22	(100)	19	(100)	41	(100)

Table 3

Risk factors for diarrhoea in children under the age of five years

Variable	Diarrhoea n =142	No diarrhoea n=459	OR CI
Mother's age (Yrs)			
15-24	49	116	1.28 (0.87-1.91)
25-34	93	343	
Mother's religion			
Christian	97	348	0,69 (0.44-1.07)
None Christian	45	111	
Mother's education			
Illiterate	38	111	1.15 (0.73-1.80)
Literate	104	348	
Mother's occupation			
Housewife	111	325	1.48 (0.92-2.3s)
Others	31	134	
Monthly income (Birr)**			
<200	69	204	1.11 (0.74-1.69)
200 or more	67	231	
Latrine available			
Yes	101	333	0.93 (0.6-1.45)
No	41	126	
Proper latrine use			
Yes	74	252	0.83 (0.52-I.S!
No	27	81	
Water source			
well	73	125	1,90 (126-2.86)*
Others	69	334	
Waste disposal			
Appropriate	47	173	0.82 (0.54-1.24))
Inappropriate	95	286	
Other U5C at home			
Yes	96	339	0.74 (0.48-1.14)
No	46	120	
Inmmunisation			
Incomplete	28	46	2.21 (1.27-3.82)*
Complete	114	413	

Table 3 *(Cont')*

Measles attack			
Yes	5	4	4.15 (0.94-18.89)*
No	137	455	
ARI			
Yes	44	72	2.41 (1.52-3.83)*
No	98	387	

**Birr (Ethiopian currency) 6 US$ *P<0.05 Cl=95% confidence interval

Table 4

Risk factors for persistent diarrhoea in children under the age of five years

Variable	PD (n=41	No PD (n=96)	OR (CI)
Mother's age (Yrs)			
15-24 or > 35	24	48	1.41 (0.6-3.2)
25-35	17	48	
Mother's education			
Illiterate	15	25	1.64 (0.7-3.9)
Literate	26	71	
Mother's occupation			
Housewife	32	74	1.06 (0.4-2.8)
Others	9	22	
Mother's religion			
Christian	29	68	1.00 (0.4-2.4)
Non Christian	12	28	
Monthly income (Birr)			
201	26	55	1.27 (03-3.0)
>200	14	39	
Latrine available			
Yes	23	73	0.43 (0.2-1.0)
No	17	23	
Proper latrine use			
Yes	17	54	0.87 (03-2.6)
No	8	22	
Water source			
Well	27	44	2.28 (1.0-5 3*)
Others	14	52	
Waste disposal			
Appropriate	10	34	0.59 (0.23-1.5)
Inappropriate	31	62	
U5C			
Yes	15	64	0.84 (0.4-1.5)
No	14	30	
Age of patient (mon)			
Less than 12	8	10	2.08 (0.7-6.4)
12 or above	33	86	
Gender			
Male	22	47	2.21 (0,5-2.7)
Female	19	49	
Type of stool			
Not bloody	27	84	0.3 (0 1-0 8*)
Bloody			
Frequency of stool			
5 times of less/day	32	76	1.40
More than 5 times	6	20	
Immunisation			
Yes	30	84	0.39 (0.14-1.08*)
No	11	12	

*p <0.05 CI=95% confidence interval

Factors associated with diarrhoeal diseases: As shown in Table 3 well source of water, immunization status, attack of measles and ARI were found to be significantly associated with diarrheal occurrence in children. In logistic regression model well as source of water and ARI in the previous two weeks were retained as significantly associated factors with diarrhea. Source of water, type of stool and status of immunization showed statistically significant associations with PD (Table 4). However, none of them were retained as significant factors in the logistic regression model.

DISCUSSION

In a rural community based under-five mortality study, the major probable causes or death were acute respiratory infections (ARI) and diarrhoea , the latter being more common among children aged 1-4 years(13). It appears that no significant variation is found in this study in comparison to the incidence of diarrhoea reported in this country about 20 years ago(2). In general, it is similar to the overall median incidence for U5C for sub-Saharan countries(14) but higher than the 1.6 episodes per child per year in Nigeria(8,15). The occurrence of diarrhoea was highest in the second year of life consistent with an earlier report(13) because of the high exposure to environmental as well as food contamination. In addition the protectivity of breast feeding also decreases after the first year of life. On the other hand the occurrence of DD was high among children aged 6-11 months in Bangladesh (16).

The mortality due to diarrhoea is known to increase in PD which also leads to malnutrition. In some studies 6-26% of the DD were found to be PD similar to this study(16-20). However, on follow up of the ADD cases almost a quarter of them progressed to PD as compared to 11% in Guatemala(19). Identification of the reason for such differences and the risk factors will provide important information for preventive measures. In previous studies blood or mucus, higher frequency, lower respiratory infections, malnutrition, vitamin A deficiency and antibiotics use were found to be associated with PD(17-18). In this series bloody diarrhoea is found to be a significant risk factor as well though in contrast to the lower frequency of bloody diarrhoea among the series in Addis Ababa(21). The unabated high incidence of ADD, the high percentage of ADD progressing to PD and the decline of immunization noted in the early 90's makes gloomy child survival in the country at least due to diarrhoea on top of the six vaccine preventable diseases.

The influence of parental characteristics in child health has varied among societies. In rural Ethiopia community maternal ethnicity, illiteracy of the father and non-membership of peoples organization were associated with excess under-five mortality(13). However, similar to previous studies maternal characteristics such as education, occupation and age had no effect on DD incidence(22,23).

ARI and well source of water were found to be determinants of DD(Table3). Though well water is usually found within the compound or in short proximity the yield is low especially during the dry season as when the study was conducted. Furthermore, in most instances the wells are dug within the compound in unsafe distance from pit latrines. From analysis of several studies, Esrey *et al*(5) concluded that improvements in water quality have less of on impact than improvements in water availability. In a heavily contaminated environment the clean water may easily be contaminated during storage or in the process of usage.

The availability of latrine, improper latrine use and garbage disposal have been significantly associated with monthly income. Friej and Walls(2) found poor housing, low income, crowded conditions, inadequate sanitation and shortage of water as risk factors associated with daily prevalence of diarrhoea in Ethiopia. On the other hand none of these factors independently was associated with diarrhoea incidence in this study. In Peru, similarly, socio-economic factors were not found to independently determine incidence but rather may be functioning through transmission factors(7). In rural Zimbabwe and Gambia no association was found between diarrhoea frequency and socio-economic factors(23). This may imply that under poor socioeconomic conditions improvements of a single environmental factor is not a sufficient condition for reducing the incidence of DD. Kolsky(24) suggests that in environments which are very heavily contaminated, presence of multiple transmission routes limits the effectiveness of controlling only one or two routes.

From the above, it can be noted that the incidence of DD and the progression of ADD to PD are quite high. Thus, mobilizing, the concerned sectors is an essential step towards decreasing DD. It is also deduced that improvements in isolated socio-environmental factors will not have significant influence on diarrhoea morbidity. Thus, it is suggested that breaking the transmission routes of DD should be promoted through inter-sectoral collaboration rather than an isolated venture.

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