DIARRHOEA IN CHILDREN DUE TO ENTEROTOXIGENIC ESCHERICHIA COLI

Pages with reference to book, From 82 To 87

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Abstract

Two hundred and ten cases of diarrhoea were investigated for enterotoxigenic Escherichia coli. Sixty eight (32.4%) yielded ETEC strains, out of which fifty seven (27.0%) were LT producers and six (2.9%) were ST producers. Drug sensitivity pattern indicate the effectiveness of gentamicine, streptomycin and chloramphenicol at a higher rate. (JPMA 36: 82, 1986).

INTRODUCTION

Acute diarrhoea is one of the major causes of illness, malnutrition and death among infants and young children in the developing countries.[1]There is now growing evidence which indicates the high incidence of ETEC associated diarrhoea in all age groups in tropical and developing countries. More over ETEC are significant in the etiology of enteritis in infants and children[2]. The incidence rate is higher in areas with poor hygienic standards, and warm climates add to ETEC infection rate and are conducive for production of one or both the recognised types of enterotoxines.[3]

MATERIAL AND METHODS

Children under five years of age were included in the study. Sample collection was made through summer of 1982 to April 1983 from paediatric unit of the Rawalpindi General Hospital, Rawalpindi.
a) Collection of Clinical Data: A total of 210 cases of diarrhoea were included in the present study. Detailed clinical history was recorded in each case, which included general information of patient, symptoms, nutritional status, stage of dehydration and other relevant features. Patients taking antibiotics ten days prior to specimen collection were not included in the study.
b) Collection and Processing of Faecal Specimen: At least Sml or 5gm faeces was collected from each patient in a sterilized container. Samples were cultured on MacConkey agar plates and incubated for 24 hours at 37°C. Suspected E. coli colonies were identified biochemically according to Edwards and Ewing (1972).
c) Assays for E. coli Enterotoxin: Heatlabile toxin was detected by Biken test.[4] Sampling for detection of heat-stable(ST) enterotoxin was performed from same Biken agar plate by picking four agar pieces (7mm each) from the outer margin of each colony which were then used in infant mouse assay.[5] The ratio of gut weight to remaining body weight by 0.083 was considered positive.
d) Antibiotic Sensitivity Test: Pure isolates were tested against Gentamicine, Ampicillin, Furoxone, Septran, Streptomycin, Tetracycline, and Chioramphenicol using Kirby..Bauer method.
e) Analysis of Data on Various Attributes of Diarrhoea Incidence: The information on diarrhoeal cases, their socioeconomic classes and ETEC types, extracted from the filled proformas were set into relative frequency distribution of age class intervals of uniform size (6 months). Diarrhoea index (which included mean number of symptoms like vomiting, dehydration, mucus and/or blood in stool)

was calculated for each age class interval. Simple co-efficient of correlation was calculated between different pairs of variables. Whenever coefficient of correlation was found significant in any of the cases, at least at $P < 0.05$, an empirical relation was worked out between the two variables on the basis of simple or quadratic regression analysis using the least square method. The results are given in

TABLE I

Age Distribution of various Attributes of 200 Cases of Diarrhoea.

Age in months	Frequency	Males	Females	LT ETEC in Stool Samples	ST ETEC in Stool	Poor class Samples	Diarrhoea index
1–6	76	58	18	25	2	56	3.70
7–12	44	23	21	13	1	27	4.00
13–18	26	14	12	9	1	20	4.18
19–24	18	9	9	1	1	13	1.90
25–30	11	6	5	2	1	7	3.93
31–36	13	7	6	2	0	9	1.95
37–42	4	1	3	0	0	3	1.12
43–48	5	3	2	1	0	3	0.60
49–54	2	2	0	0	0	1	0.00
55–60	11	8	3	4	0	5	1.35

Table I and represented diagramatically along with superimpositions.

RESULTS

Out of 210 diarrhoeal cases, fifty seven (27%) were harbouring LT producing enterotoxigenic E. coli. Heat stable enterotoxigenic E. coli strains were recovered from six cases (2.9%).

Based on socio-economic status of the families to which the infants belonged, 154 children (73.3%) belonged to poor class, 46 (21.9%) to lower middle,8 (3.8%) to the upper middle class and two infants (0.9 5%) were of rich class.

This study included 131 (62.4%) males and 79 (37.6%) females. The age distribution, frequency of infection, sex, causative agents, sOcioeconomic status and diarrhoea index of the subjects is presented in Table II.

TABLE II

Simple Linear and Quadratic Regression Equations relating various Pairs of Variables.

	Pairs of variable	Simple regression equation Y=a+bx	r
1.	Percentage incidence of diarrhoea in children of lower middle class (Y) and age in months (x)	$Y = 3.99 - 0.05^{**}x$	–0.7080
2.	Relationship between diarrhoea index (Y) and age in months (x)	$Y = 4.47 - 0.07^{**}x$	–0.84162
3.	Percentage incidence in male children (Y) and diarrhoea index (x)	$Y = -0.21 + 2.65^{**}x$	0.6199
4.	Percentage incidence in female children (Y) and diarrhoea index (x)	$Y = -0.28 + 1.94^{**}x$	0.6199
5.	Percentage incidence of diarrhoea due to LT (Y) and diarrhoea index (x)	$Y = 0.53 + 2.77^{**}x$	0.6872
6.	Percentage incidence of diarrhoea due to bacteria other than LT (Y) and diarrhoea index (x)	$Y = 0.53 + 2.77^{**}x$	0.6872
	Pair of variables	Quadratic regression equation $Y=a+b_1x+b_2x^2$	R
7.	Percentage incidence of diarrhoea due to LT (Y) and age in months (x)	$Y = 13.19 - 0.6944^{**}x$	0.9661
8.	Percentage incidence of diarrhoea due to bacteria other than LT (Y) and age in months (x)	$Y = 22.45 - 0.9292^{**}x + 0.0104x^2$	0.9756
9.	Percentage incidence of diarrhoea irrespective of sex (Y) and age (x)	$Y = 37.2031 - 1.6938^{**}x + 0.0198x^2$	
10.	Percentage incidence of diarrhoea in males (y) and age in months (x)	$Y = 23.2613 - 1.1405^{**}x + 0.0141^{*}x^2$	0.81
11.	Percentage incidence of diarrhoea in females (y) and age in months (x)	$Y = 13.7601 - 0.5428^{**}x + 0.0056^{**}x^2$	0.81
12.	Percentage incidence of diarrhoea in poor (y) and age in months (x)	$Y = 28.005 - 1.2688^{**}x + 0.01461^{*}x^2$	0.86

$^{**}p < 0.01$

$^{*}p < 0.05$

b – simple regression coefficient

b_1 and b_2 – partial regression coefficient

r – simple correlation coefficient

R – multiple correlation coefficient

Percentage of diarrhoea! cases observed irrespective of sex (Figure 1)

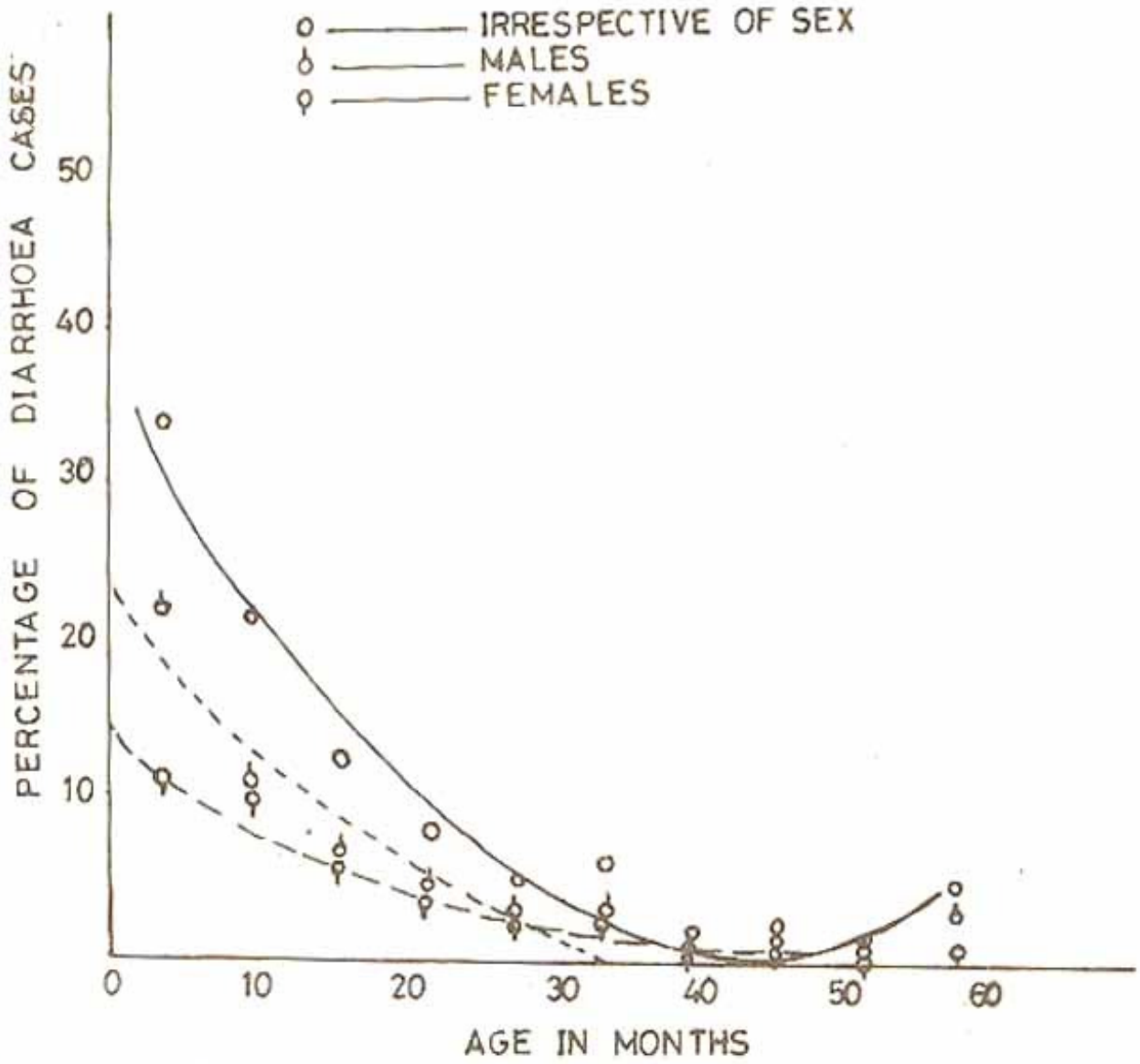

Figure 1. Relationship between age and percentage of Diarrhoea cases in children (linear regression analysis).

showed a sharp decline with the age and reaching a minimum between 40 and 50 months of age. Beyond 50 months, the percentage showed a slight increase.

Diarrhoea among females remained low and showed a gradual decrease with age. The percentage of female children visiting the hospital was very low. The diarrhoea indices decreased with age, reaching a peak in the early months and decreasing gradually till 65 months of age (Figure 2).

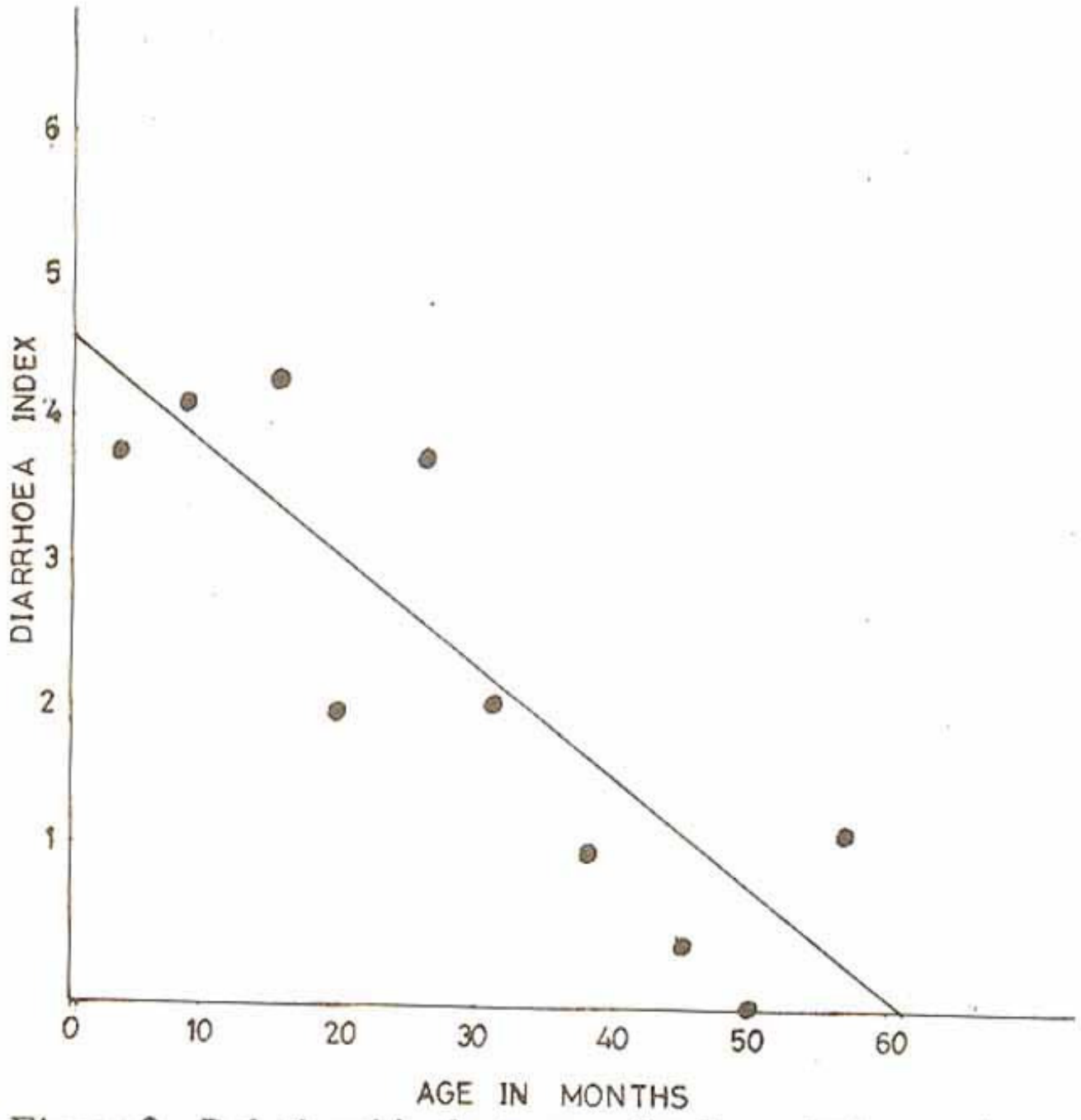

Figure 2. Relationship between diarrhoea index and age.

Children belonging to poor socio-economic class showed a sharp decline in diarrhoeal frequences with the age, and minimum cases were recorded between 40 to 50 months of age; While among middle class children, diarrhoea remained very low in the earlier months of age, later it decreased (Figure 3).

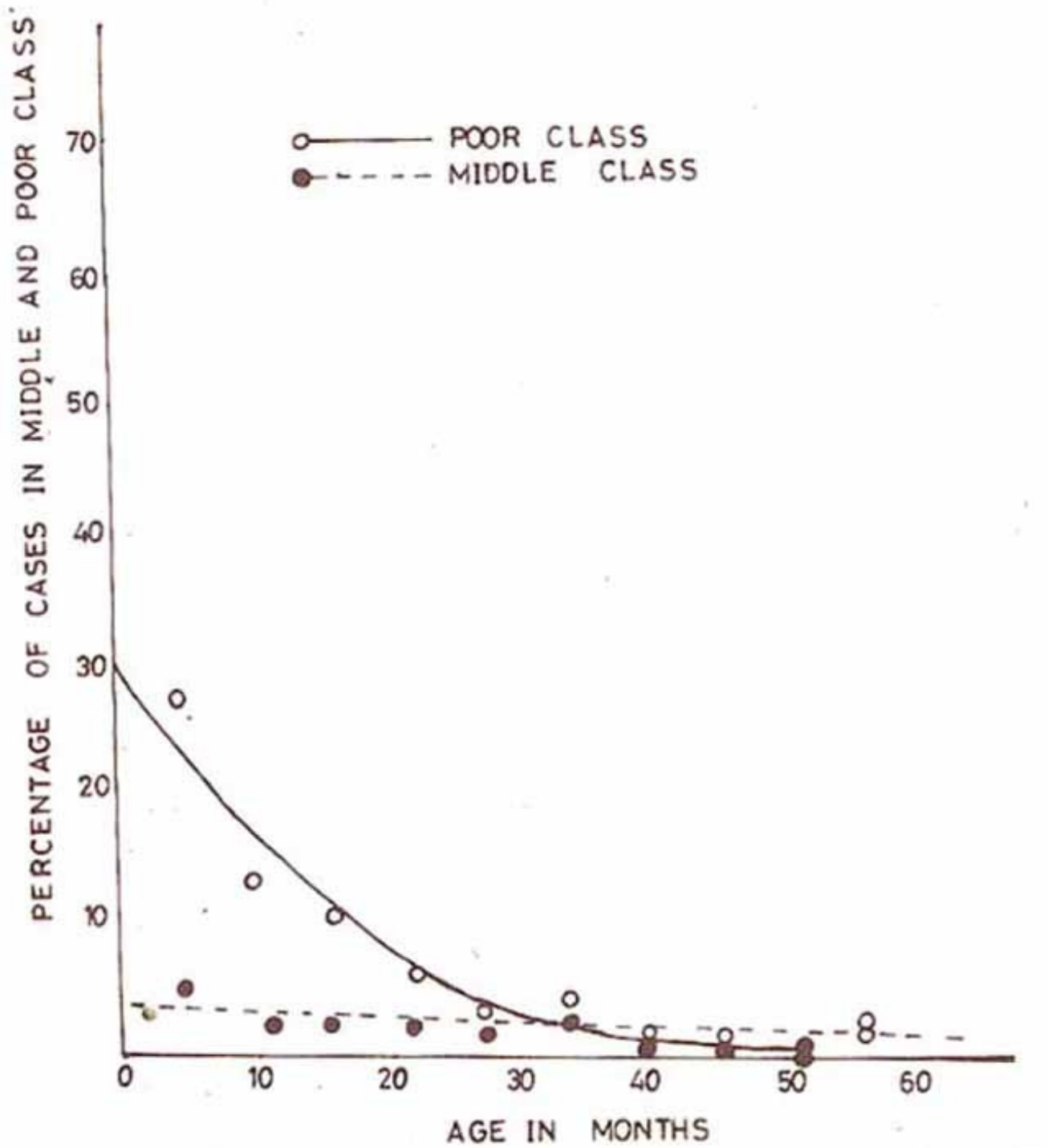

Figure 3. Percentage of diarrhoea cases in children of different socioeconomic groups related to age (linear regression analysis).

The diarrhoea due to LI producing ETEC showed a very sharp curvilinear decline with increase in age. In the case of diarrhoea due to organisms other than LT, the percentage was higher in the first few months of life but showed a sharp decline with increase in age (Figure 4).

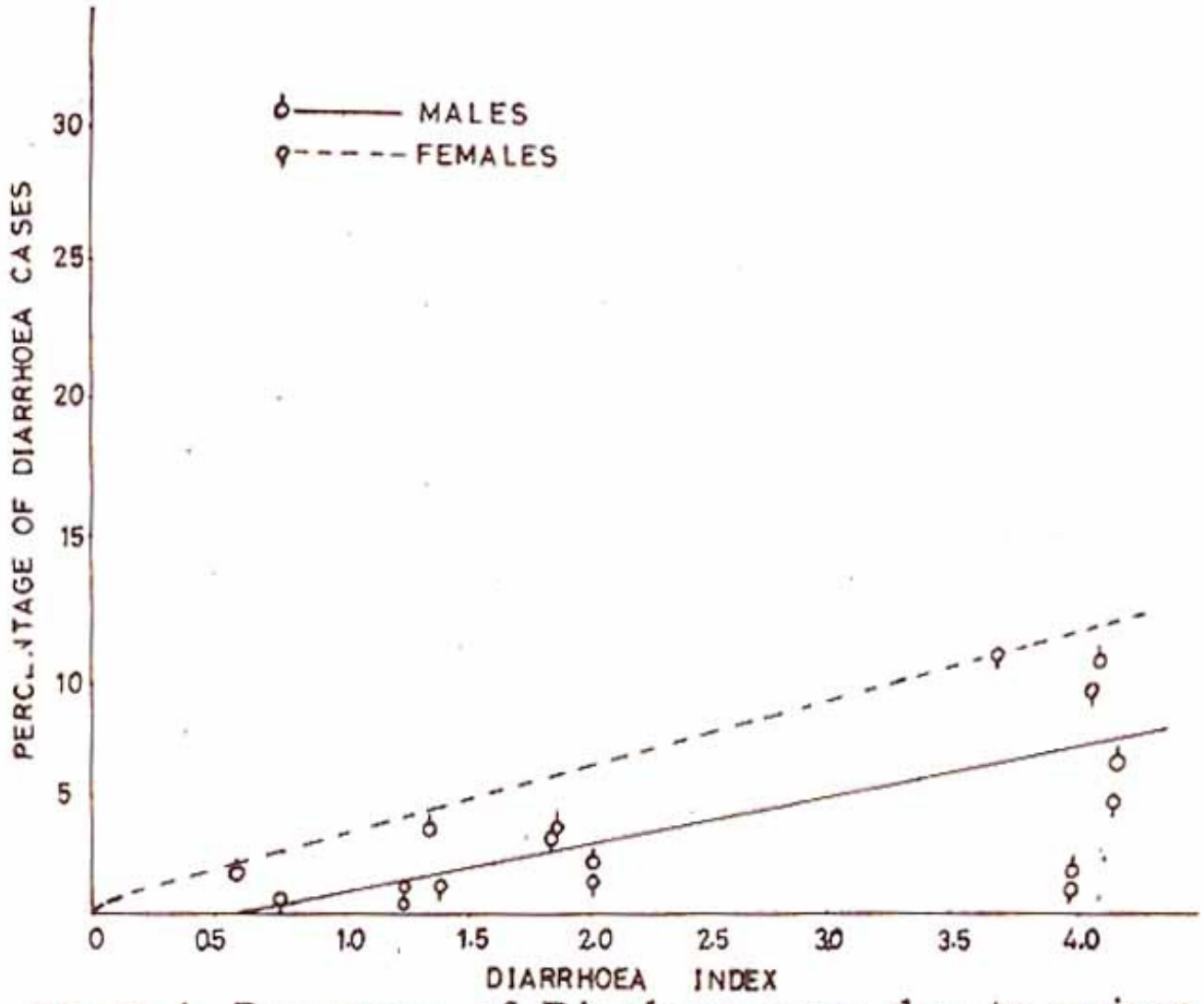

Figure 4. Percentage of Diarrhoea cases due to various bacteria related to age (linear regression analysis).

Diarrhoea in male and female children (Figure 5)

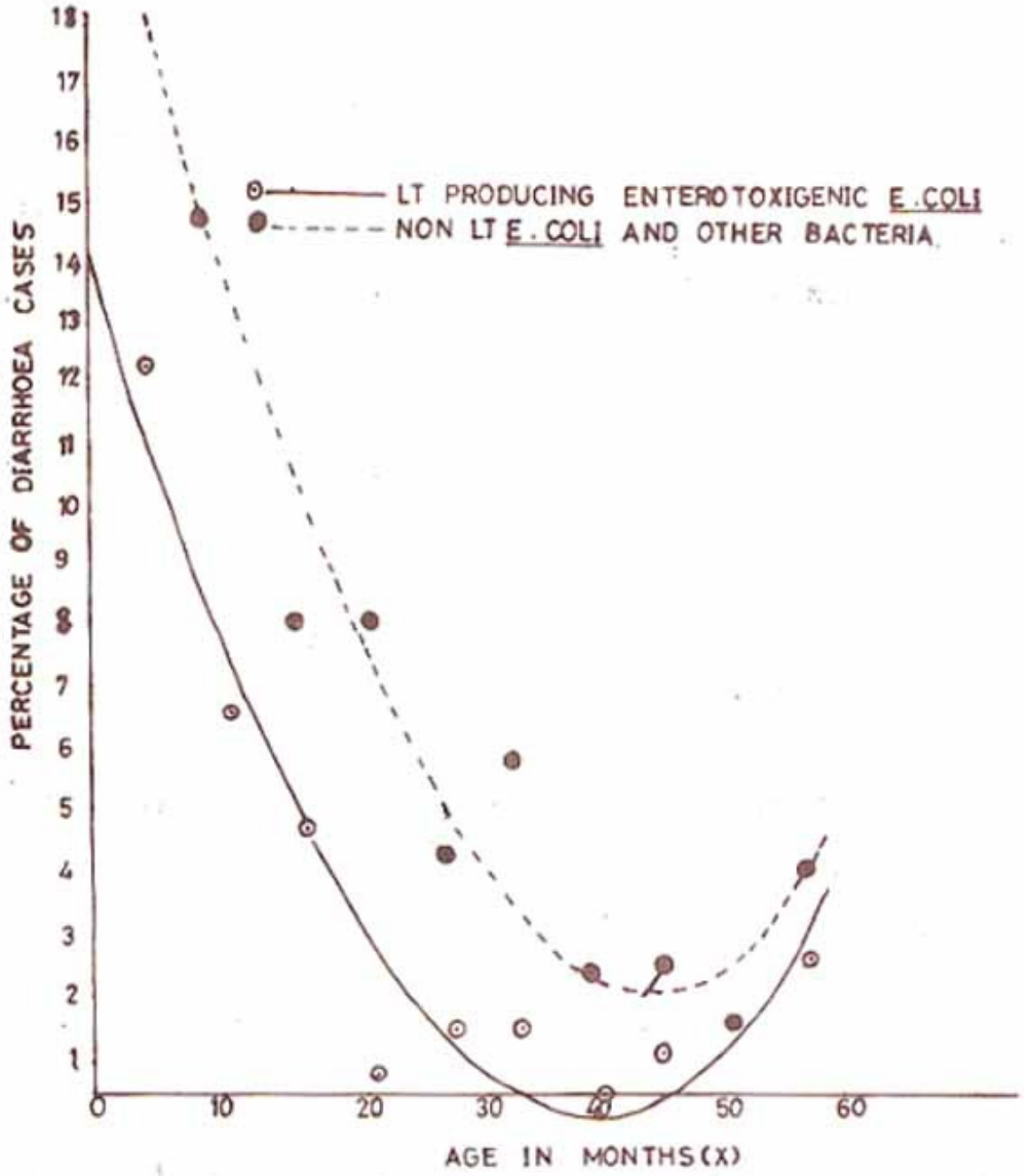

Figure 5. Relationship between diarrhoea index and percentage of cases in both sexes. (linear regression analysis).

showed a strong positive correlation with diarrhoea index. The intensity of disease itself was a direct evidence of expected percentage incidence to a high degree of significance ($P < 0.01$).

Antibiotic sensitivity pattern of the LT producing strains showed 100% sensitivity to gentamicine followed by Chloramphenicol (90%), Streptomycin (90%),Furoxone (75%) and Septran (70%). Tetracycline resistance was found in 38% cases.

DISCUSSION

Diarrhoea due to heat labile and heat stable ETEC was observed in 37% cases. This isolation rate is similar to those reported from Bangladesh,[6] where 37% of the cases under S years of age had diarrhoea due to ETEC, and out of which 25 percent were under 2 years of age. In another study ETEC among 18-54 percent of the cases were recovered in India.[7] The most prevalent strain found in this study was LT producing ETEC (27%), similar high attack rates due to LT has been reported from Kenya. In Bangladesh ST strain are more prevalent[8].

In the present study diarrhoea was high undertwelve months of age which subsequentlydeclined. These findings are in agreement with reports from Central Java[9] and Souch Africa[6], where ETEC diarrhoea was high among children under two years of age.

The disease declines after three years of age and remains suppressed with an increase in age. Similar findings were observed in another study[6]. Our results ale similar to those in Indonesia[10] where diarrhoea was highest in children below five years of age and then decreased with slight degree of fluctuation as the age increases.

Diarrhoea in male and female children has shown a negative correlation with age i.e. disease decreases in both the sexes with an increase in age. A close examination of the age specific diarrhoea showed a similar curve in both sexes (Figure 1). However, there were differences in the attack levels showing a higher incidence of the males throughout the studied age (differential coefficient of the incidence function) and may be due to unequal rates of admissions.

Age specific LT diarrhoea has appeared less frequently as compared to non LT producers (Figure 4). Diarrhoea due to ETEC does decline at the same rate as that due to the other organisms. Similar observations were also reported from Bangladesh[8].

Diarrhoea index has also shown a strong positive correlation with sex specific diarrhoea (Figure 5), and female children, showing that females are more susceptible to diarrhoea due to LT producing E. coiL

The sample collected from the local hospital largely included patients belonging to the families having an income of less than two thousand rupees per month. The sample as a whole was distributed in four arbitral income classes namely rich class (Rs. 4000 or above) , upper middle class! (Rs.2000-4000 income), lower middle class (Rs. 1000-2000 income) and poor class (less than Rs.1000 income). Of these only the last two sectors showed significant correlation (Figure 3). Similar observations were reported[11], in which majority of the cases occur in families with poor literacy levels, low income and unhygienic living condition.

Information on antibiotic resistance of ETEC strains are rather limited. Most resistant strains have been reported from Asia[12,13]. Gentamicine (100%), Streptomycin (90%) and Chioramphenicol (90%) were most effective while 38% of Tetracycline resistant strains were also seen which is in agreement with another study[6] where 47% strains were resistant to Tetracycline. It is proposed that studies should be carried out on seasonal occurrance of ETEC in children and adults which will help in identifying the magnitude of the diarrhoea due to ETEC.

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