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RESEARCH ARTICLE

STRUCTURAL EQUATION MODELING APPROACH ON INFANT DIARRHEA CAUSING BACTERIA IN NAMAKKAL DISTRICT

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ABSTRACT

The data obtained by conducting interviews, examinations pus sampling of respondents who have been determined. The sample size of diarrhoea sample was 82 for the isolation of diarrhoea causing bacteria such as Escherichia coli, Salmonella sp., Shigella sp., Vibrio sp. and Yersinia sp. Among 82 diarrheal stool samples, 48 (58.5%) *Escherichia coli* and 6 (7.3%) *Salmonella* sp. was isolated. 25- 36 months old children were the highest rate of E. coli infection while Salmonella sp.infection was in37- 48 months old children. The highest E.coli and Salmonella infection occurred in low income group, followed by middle income group and high income group. The influence of the number of children living in the house directly reflected the *E. coli* and *Salmonella* infection. The children drunk unprotected water had the highest occurrence of infection than protected water. Those children of families with latrines had a lower prevalence of diarrhoea disease than those children whose families did not. The disposal of the child's stool throw away in open surroundings was the highest rate of infection. The weekly kitchen cleaning had a chance for more rate of infection. Domestic, pet animals in house and flies in the kitchen contaminated all food items which had the highest *E.coli* and *Salmonella* infection among the children.

Key words: Structural Equation, Diarrhoea, and *Escherichia coli.*

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INTRODUCTION

Infants in medicine are also referred to as children that are still very young, below the age of 5 years. Therefore infantile diarrhea can now be said to be the frequent loss of fluid from the bowel of very young individuals. The loss of fluid through diarrhea can cause severe dehydration which is one of the causes of death in people with diarrhea. Infections are the major cause of severe morbidity and mortality among children worldwide (lawn *et al.,* 2005). In world, 6 million children die each year from diarrhoea, where the common deaths come about in developing countries (Parashar *et al.,* 2003). In mainly diarrhoeal deaths in India were 0.212 million in 2010 (Liu *et al.,* 2012). Those associated with persistent diarrhoea occur in malnourished children and is usually disproportionately high, accounting for up to 45 per cent of diarrhoeal deaths in Brazil, Bangladesh and in several African countries (Prescott *et al.,* 2002). Alternatively, the relationship between childhood diarrhoea and parental socioeconomic, behavioral and household environmental factors was not dependable (Timaeus and Lush, 1995; Van Derslice *et al.,* 1994).

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People living in developing countries with poor admittance to safe water, hygiene, or cleanliness infrastructure has increased threat of exposure to various pathogens that can cause diarrhoea diseases (Arvelo, 2010, Kermani, 2010). The major cause of death for children is affected by diarrhoeagenic bacteria *E. coli* spp., *Vibrio* spp., *Salmonella* spp., *Aeromonas*spp., *Shigella, Yersinia enterocolitica*, Rotavirus, *Cryptosporidium* spp., *Entamoebahistolytica*, and *Giardia lamblia*. Amongst children under five years of age, diarrhoeagenic *E. coli* (DEC) such as enterotoxigenic *E. coli* (ETEC), enteropathogenic *E. coli* (EPEC), enter aggregative*E. coli* (EAEC) are the most vital enteric pathogens and are accountable for 30 to 40 per cent of all the diarrhoea episodes in developing countries (O'Ryan *et al.,* 2005; Isidean*et al*.,2001). *Yersinia enterocolitica* is associated with a wide range of clinical and immunological manifestations, responsible for intestinal diseases, including enter colitis with an inflammatory diarrhea in affected infants and young children; acute terminal ileitis and mesenteric lymphadenitis mimicking appendicitis in older children and young adults, as well as rare extra intestinal manifestations including urinary tract and respiratory tract infection (empyema), osteoarticular infection (reactive arthritis), erythema nodosum, infected mycotic aneurysm (Bottone, 1997; Kwaga *et al.,* 1992).

Yersinia enterocolitica is most often transmitted by consumption of contaminated food, unpasteurized milk or inadequately pasteurized milk, untreated water, or by direct or indirect contact with animals (Sabina *et al.,* 2011). Socioeconomic factors may affect, directly and indirectly, environmental, behavioral, nutritional, and demographic risk factors, with the exception of age and sex (Green *et al.,* 2009). The frequency and severity of diarrhea is aggravated by lack of access to sufficient clean water and sanitary disposal of human waste, inadequate feeding practices and hand washing; poor housing conditions and lack of access to adequate and affordable health care (Gerald *et al.,* 2001).

MATERIALS AND METHODS

Study Design

This was a comparative cross-sectional study that examined socioeconomic, environmental factors of children and Behavioral factors related factors as exposure variables and Escherichia coli, Salmonella sp., Shigella sp., Vibrio sp. and Yersinia sp.indiarrhoea stool samples as an outcome variable. The study attempted to compare these variables in the children below the age group of 5 years in Nadukkombai, Namakkal district, Tamilnadu, India and was conducted from May to September, 2015.

Sampling technique and sample size

The data obtained by conducting interviews and diarrhoea sample of respondents who have been determined. The sample size of diarrhoea sample was 82 for the isolation of diarrhoea causing bacteria.

Variables

Outcome (Dependent) variable- Include occurrence of Escherichia coli, Salmonella sp., Shigella sp., Vibrio sp. and Yersinia sp. from diarrhoea stool samples at the time of the survey.

Explanatory (Independent) variable

- Socioeconomic status- includes age category, gender of children and literacy status, comprehensive mother's knowledge on cause of diarrhea and economic status of parents in the Kollikills, Namakkal district, Tamilnadu.
- Study of environmental factors of children in number of children living in the house, floor of the house, drinking water, latrine in the house, disposal of the child's stool, kitchen cleaning and flies in the kitchen, domestic animal in house and pet animal in house.
- Study of behavioral factors related to hand-washing by mothers before feeding children, hand-washing by mothers before preparing food for children, methods of storing food for later use and buying food for children from street vendors.

Data management and analysis: The data entry was performed using IBM SPSS version-20. Frequencies were used to check for missed values and variables.

Collection of sample: 82 stool samples were collected from infants at the age group below 5 years with cases of acute gastroenteritis attending both private and public hospitals/medical laboratories in Namakkal, Tamilnadu. The samples were collected in sterile plastic container and then swabs were immediately transported to the laboratory for culture. Diarrhea was defined by the occurrence of >3 loose stools, liquid or watery or at least 1 bloody stool in a 24 h period. Samples from patients who received antibiotics before admission or during their hospital stay were excluded from the study.

Isolation of Diarrhoea causing bacteria

Each sample was inoculated on Eosin methylene blue agar for isolation of Escherichia coli, Salmonella, Shigella and Yersinia, Thiosulfate citrate bile salts sucrose agar for Vibrio sp. If colorlesscolonies exhibited on Eosin methylene blue agar plates, Salmonella-Shigella (SS) agar was used for Salmonella and Shigella and Yersinia Selective Agar for *Yersinia* sp. identification. The culture plates were incubated at 37°C for 24 hours and observed for growth through the formation of colonies. The isolates were identified by their morphology and biochemical characteristics.

Maintenance of Culture

The single isolated colonies obtained from selective agar plates were sub cultured on nutrient agar slants and incubated at 37ºC for 24 h and then stored at 4°C for further analysis.

Preliminary Examination of Culture

Gram's Staining: Gram's staining was carried out as per Hucker's modification and observed cell morphology and arrangements.

Colony morphology on Solid Media: The isolates were identified by the characteristic growth on the selective media.

Test for Motility: Motility was tested by the hanging drop method. A small drop of distilled water was placed on the middle of a cover slip and mixed with the young culture. The margin of a cover slip was smeared with a little paraffin jelly. The cavity slide was inverted on the cover slip in such a way that the cover slip got attached to the slide and on turning upside down, the culture drop hangs into the cavity. Motility was observed under the microscope.

Biochemical Test: Biochemical tests of selected isolates were done according to Bergey's manual of determinative Bacteriology (Krieg and Holt, 1994).

Catalase Test: A drop of 3% hydrogen peroxide was placed on a clean glass slide and a loop full of culture was added.

Oxidase Test: A single colony was taken with sterile wooden stick and was smeared on an oxidase disc (Tetramethyl Paraphenylene Diamine Di-hydrochloride).

Urease Test: A loopfull of culture was inoculated into Christenson's urea broth tube. Production of urease was indicated.

Indole Test: A loop full of culture was inoculated into peptone water and incubated at 37^0 C for overnight. After incubation 0.5ml of Kovac's reagent was added.

Methyl Red Test: The colony from nutrient agar slant was inoculated into MR-VP medium and was then incubated at 37^0

C for overnight. The test employed to detect the production of acid during fermentation. In addition 0.5 ml of methyl red was added.

Voges Proskauer Test: A loopfull of culture was inoculated into MR-VP medium, which was incubated at 37^0C for overnight, to detect acetyl methylcarbinol from pyruvic acid. In addition of VP reagent (0.5ml of 5% alpha-naphthol and 0.5ml of 40% KOH) was added.

Citrate Utilization Test: The culture was streaked into the Simmon's citrate agar slant and incubated at 37^0C for overnight.

Antibiotic Susceptibility Test Using Disc Diffusion Method: Antibiotic and essential oil sensitivity testing was done for all the isolates on Mueller-Hinton agar by modifying Kirby-Bauer disc diffusion technique (Bauer *et al.,* 1966). The nutrient broth was prepared and sterilized at 121°C and inoculated with the bacteria and then incubated at 28°C for 48hrs. After the incubation period the broth culture were inoculated onto surface of the Mueller-Hinton agar plates and antibiotic discs were placed. Tap the discs with a sterile forceps after placing them on the agar for complete contact with the medium surface. Then the plates were incubated at 28°C for 24hrs. The zone of inhibition and resistance was measured, recorded and interpreted according to the recommendation of the disc manufacture. In this study 13 antibiotics were used. Each belongs to different groups. Some of the standard antibiotics are: Amikacin (10mcg), Amphicillin/Claxacillin (10 mcg) , Amoxyclav (30 mcg), Cefdinir (5 mcg), Cefixime (5 mcg), Cefotaxime (30 mcg), Ceftazidime (30 mcg), Ceftriaxone (30 mcg), Cefuroxime (30 mcg), Cephalexin (30 mcg), colistin (50 mcg) , Co-Trimoxazole (25 mcg), Floxidin (30 mcg), Gentamycin (30 mcg), Norflexacin (10 mcg) and Streptomycin (25 mcg).

RESULTS

Children's and Parent's socio-demographics characteristics

A total of 82 under-five years old children who included in this study the minimum age of cases was less than 12 months and the maximum age was 60 months during month of May to September -2015 in Nadukkombai, Namakkal district. Children aged less than 12 months had 13 cases, making up 15.9 % of the total; 13-24 month had 9 cases (11.0%); 25-36 and 37-48 months had 19 cases (23.2%) and 48-60 month had 22 cases (26.8%). The number of males (43) was higher than females (39) in almost all age groups. Forty four (53.7%) and 38 (46.3%) parents were illiterate and literate respectively. Sixty one per cent parents had sufficient knowledge on causes of diarrhea while 39 % parents not had diarrhea causing.31.7% of parents were low income group and 47.6 % were middle income group and 20.7% were high income group.

Behavioral factors of the study households

In presented that 53.7 % mothers were hand wash practically before feeding children, 46.3% of mothers were hand wash sometimes. During preparation of food for children, 35.4 mothers followed the hand wash and 64.6% of mothers did some times. Most of the houses (41.5%) used disk-cover for children's food storage for later use, 31.7% stored in refrigerator, 20.7% houses stored in larder and 6.1 % houses did not keep for later use. The 56.1 of children brought food items from street vendors and 43.9% cases not had street foods.

Isolation and identification of diarrhea causing bacteria

Among 82 diarrheal stool samples, 48 (58.5%) *Escherichia coli* and 6 (7.3%) *Salmonella* sp. was isolated. The other suspected bacteria such as *Shigella* sp., *Vibrio* sp. and *Yersinia* sp. were not detected and isolated from 82 diarrheal stool samples. The morphological; biochemical characterization of *E.coli* and *Salmonella* sp. were noticed in table- 1.

Distribution of respondent's socioeconomic parameters on diarrhea causing bacteria

Distribution of respondents with *E. coli* and *Salmonella* sp. infection were tabulated in table-2. In age category, 25- 36 months old children (17 cases) were the highest rate of *E. coli* infection while *Salmonella* sp. infection were in 37- 48 months (3 cases). Nine cases of 48- 60 months old were infected with *E.coli* followed by 37- 48 months and less than 12 months (8 cases). One cases of *Salmonella* sp. infection in less than 12 months, 13-24 month old and 48-60 month old children. Twenty six and 5 cases of male children had infected with *E.coli* and *Salmonella* sp. while female had 22 and 1 cases respectively. 28 and 4 cases were infected with *E.coli* and *Salmonella* sp. in the children of illiterate parents while 20 and 2 cases were infected with *E. coli* and *Salmonella* sp. in the children of literate parents. Mother's knowledge on cause of diarrhoea was reduced *E. coli* infection while it was contradictive in *Salmonella* sp. infection. In the economic status of parents, the highest *E. coli* and *Salmonella* sp. infection occurred in middle and low income group than high income group.

Distribution of respondent's environmental parameters on diarrhea causing bacteria

Distribution of respondent's environmental parameters on diarrhea causing bacteria was presented in table-3. The influence of the number of children living in the house directly reflected the *E. coli* and *Salmonella* infection. 27 and 3 cases were infected with *E. coli* and *Salmonella* in more than two children in the house respectively. The children were living in mud floor in house and portico was higher infection (31 and 4 cases of *E. coli* and *Salmonella* respectively) than cement and others. The children drunk unprotected water had the highest occurrence of infection (32 and 2 cases of *E. coli* and *Salmonella* respectively) than protected water. The latrine in the house was highly influenced on the *E.coli* and *Salmonella* infection. In the present study, house without latrine had the highest infection cases (28-*E.coli* and 5-*Salmonella*) and disposal of the child's stool throw away in open surroundings was 25 cases of *E.coli* infection. In the aspect of neat kitchen cleaning, weekly cleaning had a chance for more rate of infection (25 and 3), followed by 2-3 times/ week (17 and 1) and daily cleaning (6 and 2). Domestic, pet animals in house and flies in the kitchen contaminated all food items which had the highest *E.coli* and *Salmonella* infection among the children.

Distribution of respondent's mother behavior parameters on diarrhea causing bacteria: Distribution of respondent's mother behavior parameters on diarrhea causing bacteria were presented in table-4.

Table 1. Morphological and biochemical characteristics of E. coli and Salmonella sp. isolates from diarrheal stool samples

S.No	Biochemical	*E. coli*	*Salmonella* sp.
1	Gram's staining	Gram negative	Gram negative
2	Motility	Motile	Motile
3	Oxidase test	Negative	Negative
4	Catalase test	Positive	Positive
5	Selective media for identification	Eosin methylene blue	Salmonella Shigella agar
6	Colonies colour on selective media	Metallic sheen	Colorless, usually with black center
7	Urease test	-	-
8	Indole test	+	-
9	Methyl red test	+	+
10	VogesProskauer test	-	-
11	Citrate utilization test	-	-

Table 2. Distribution of respondent's socioeconomic parameters on diarrhea causing bacteria

Variables	Category	Bacterial agents associated with infantile diarrhea			Total
		E. coli	*Salmonella* sp.	No bacterial agents	
Age category	Less than 12 months	8	1	4	13
	13-24 months	6	1	2	9
	25- 36 months	17	0	2	19
	37- 48 months	8	3	8	19
	48- 60 months	9	1	12	22
Gender of children	Male	26	5	12	43
	Female	22	1	16	39
Literacy status of parents	Illiterate	28	4	12	44
	Literate	20	2	16	38
Mothers knowledge on cause of diarrhoea	No	26	1	5	32
	Yes	22	5	23	50
Economic status of parents	Low (< 50000)	16	2	8	26
	Middle (1 to 2 Lakhs)	23	3	13	39
	High (>2 Lakhs)	9	1	7	17

Table 3. Distribution of respondent's environmental parameters on diarrhea causing bacteria

Variables	Category	Bacterial agents associated with infantile diarrhea			Total
		E. coli	*Salmonella* sp.	No bacterial agents	
Number of children living in the house	More than 2 children	27	3	8	38
	Less than 2 children	21	3	20	44
Floor and portico of the house	Mud	31	4	11	46
	Cement or others	17	2	17	36
Drinking water	Unprotected	32	2	10	44
	Protected	16	4	18	38
Latrine in the house	No	28	5	24	57
	Yes	20	1	4	25
Disposal of the children stool	Throw away in open surroundings	25	1	10	36
	Put in the latrine	23	5	18	46
Neat kitchen cleaning	Every day	6	2	3	11
	2-3 times/ week	17	1	11	29
	Weekly	25	3	14	42
Flies in the kitchen	No	12	0	17	29
	Yes	36	6	11	53
Domestic animals in house	No	16	4	19	39
	Yes	32	2	9	43
Pet animals in house	No	21	4	11	36
	Yes	27	2	17	46

Table 4. Distribution of respondent's mother behavior parameters on diarrhea causing bacteria

Variables	Category	Bacterial agents associated with infantile diarrhea			Total
		E. coli	*Salmonella* sp.	No bacterial agents	
Hand washing by mothers before feeding children	Usually	20	2	22	44
	Sometimes	28	4	6	38
Hand washing by mothers before preparing food for children	Usually	18	2	9	29
	Sometimes	30	4	19	53
Methods of storing food for later use	Not storing food for later use	4	1	0	5
	Storing food in the larder	15	1	1	17
	Storing food in refrigerator	6	2	18	26
	Storing food in disk-cover	23	2	9	34
Buying food for children from street vendors	No	15	3	18	36
	Yes	33	3	10	46

Table 5. Antibiotic susceptibility patterns of E. coli isolates

S.No	Name of the Antibiotics	Sym bol	Conc./ disc	Susceptible		Intermediate		Resistant	
				No. of cases	%	No. of cases	%	No. of cases	%
1	Ceftazidime	CAZ	30mcg	45	93.8	3	6.3	0	0
2	Cefotaxime	CTX	30mcg	7	14.6	22	45.8	19	39.6
3	Ceftriaxone	CTR	30mcg	12	25	14	29.2	22	45.8
4	Amikacin	AK	30mcg	17	35.4	11	22.9	20	41.7
5	Ampicillin	AMP	30mcg	0	0	0	0	48	100
6	Co-trimaxazole	COT	25mcg	48	100	0	0	0	0
7	Gentamicin	GEN	10mcg	43	89.6	4	8.3	1	2.1
8	Cefuroxime	CXM	30mcg	37	77.1	9	18.8	2	4.2
9	Imipenem	IPM	10mcg	13	27.1	19	39.6	16	33.3
10	Tetracycline	TE	30mcg	8	16.7	22	25	28	58.3
11	Streptomycin	S	10mcg	0	0	22	45.8	26	54.2
12	Rifampicin	RIF	5mcg	0	0	0	0	48	100
13	Erythromycin	E	15mcg	0	0	0	0	48	100

Table 6. Antibiotic resistant and sensitive patterns of Salmonella isolates

S.No	Name of the Antibiotics	Symbol	Conc./Disc	*Salmonella* isolates					
				1	2	3	4	5	6
1	Ceftazidime	CAZ	30mcg	22	20	19	22	23	21
2	Cefotaxime	CTX	30mcg	21	17	16	23	21	18
3	Ceftriaxone	CTR	30mcg	22	24	26	20	28	24
4	Amikacin	AK	30mcg	22	18	19	22	21	20
5	Ampicillin	AMP	30mcg	15	20	18	14	21	17
6	Co-trimaxazole	COT	25mcg	9	8	15	14	12	10
7	Gentamicin	GEN	10mcg	21	23	19	20	24	21
8	Cefuroxime	CXM	30mcg	18	20	21	17	18	22
9	Imipenem	IPM	10mcg	25	24	28	24	26	24
10	Tetracycline	TE	30mcg	14	18	19	13	15	17
11	Streptomycin	S	10mcg	13	15	17	10	11	11
12	Rifampicin	RIF	5mcg	8	7	0	9	0	0
13	Erythromycin	E	15mcg	0	0	0	0	0	0

Table 7. Antibiotic susceptibility patterns of Salmonella isolates

S. No	Name of the Antibiotics	Symbol	Conc./ disc	Susceptible		Intermediate		Resistant	
				No. of cases	%	No. of cases	%	No. of cases	%
1	Ceftazidime	CAZ	30mcg	4	66.7	2	33.3	0	0
2	Cefotaxime	CTX	30mcg	0	0	1	16.7	6	83.3
3	Ceftriaxone	CTR	30mcg	4	66.7	2	33.3	0	0
4	Amikacin	AK	30mcg	6	100	0	0	0	0
5	Ampicillin	AMP	30mcg	4	66.7	2	33.3	0	0
6	Co-trimaxazole	COT	25mcg	0	0	3	50	3	50
7	Gentamicin	GEN	10mcg	6	100	0	0	0	0
8	Cefuroxime	CXM	30mcg	5	83.3	1	16.7	0	0
9	Imipenem	IPM	10mcg	6	100	0	0	0	0
10	Tetracycline	TE	30mcg	4	66.7	2	33.3	0	0
11	Streptomycin	S	10mcg	2	33.3	1	16.7	3	50
12	Rifampicin	RIF	5mcg	0	0	0	0	6	100
13	Erythromycin	E	15mcg	0	0	0	0	6	100

The hand washing practices of mothers influenced *E.coli* and *Salmonella* contamination during feeding children and food preparation. Hand wash before feeding, 28 and 4 cases of *E.coli* and *Salmonella* respectively were infected in occasionally. Hand-washing by mothers before preparing food for children was influenced in 30 and 4cases of *E.coli* and *Salmonella* respectively in occasionally. Food was stored in disk-cover and larder had highest *E.coli* and *Salmonella* infection when compared with food stored in refrigerator and not storing food for later use. In the case of buying food for children from street vendors, 33 cases of *E.coli* and 3 cases of *Salmonella* infection was occurred when compared with not buying the food from street vendors.

Antibiotic susceptibility patterns of diarrhea causing bacteria

Antibiotic susceptibility patterns of *E. coli* from the diarrheal stool sample of child below 5 years old was tabulated in table- 5 and 6. Among 48 isolates, all were resistant to ampicillin, rifampicin and erythromycin while susceptible to co-trimaxazole. 93.8 % of isolates were susceptible to ceftazidime followed by gentamicin (89.6%), cefuroxime (77.1%), amikacin (35.4%), imipenem (27.1%), ceftriaxone (25%), tetracycline (16.7%) and cefotaxime (14.6%). Antibiotic susceptibility patterns of *Salmonella*from the diarrheal stool sample of child below 5 years old was tabulated in table-. Among 6 isolates, all were resistant to rifampicin and erythromycin while susceptible to amikacin, gentamicin and imipenem. 83.3 % of isolates were susceptible to cefuroxime followed by ceftazidime, ceftriaxone, ampicillin and tetracycline (66.7%) and streptomycin (33.3%).

Pearson's Correlation Matrix

Pearson's correlation matrix showed the pair wise association, between socio economic, environmental and behavior factors on diarrhea causing bacteria (Table 9).

Table 8. Pearson's correlation coefficients of variables used in the SEM

	Age category	Child Gender	Literacy Status	Mothers knowledge	Economic Status	No of children	House Floor	Drinking water	Latrine in the house	Disposal stool	Kitchen Cleaning	Flies in the kitchen	Domestic animals	Pet animals	HW - before feeding	HW- before preparing food	Food storage	Buying street food	Bacterial agents - diarrhea
Age category		.404	.757	.036	.385	.878	.123	.081	.265	.140	.289	.183	.171	.839	.082	.883	.134	.559	.035
Child Gender	.404		.639	.727	.697	.399	.409	.364	.317	.204	.249	.313	.811	.168	.975	.925	.938	.700	.279
Literacy Status	.757	.639		.600	.202	.543	.562	.543	.844	.764	.674	.511	.364	.764	.052	.476	.065	.307	.177
Mothers knowledge	.036	.727	.600		.879	.330	.356	.204	.275	.183	.361	.041	.922	.637	.154	.083	.165	.637	.002
Economic Status	.385	.697	.202	.879		.801	.061	.202	.565	.550	.168	.954	.697	.771	.333	.370	.148	.013	.513
No of children	.878	.399	.543	.330	.801		.307	.543	.251	.889	.910	.003	.975	.011	.000	.241	.679	.459	.019
House Floor	.123	.409	.562	.356	.061	.307		.764	.056	.213	.460	.902	.700	.597	.764	.208	.800	.722	.029
Drinking water	.081	.364	.543	.204	.202	.543	.764		.452	.236	.674	.476	.002	.764	.294	.511	.376	.307	.012
Latrine in the house	.265	.317	.844	.275	.565	.251	.056	.452		.000	.881	.677	.599	.016	.844	.285	.634	.626	.015
Disposal stool	.140	.204	.764	.183	.550	.889	.213	.236	.000		.904	.048	.957	.031	.562	.561	.352	.213	.216
Kitchen Cleaning	.289	.249	.674	.361	.168	.910	.460	.674	.881	.904		.329	.189	.619	.096	.053	.785	.419	.958
Flies in the kitchen	.183	.313	.511	.041	.954	.003	.902	.476	.677	.048	.329		.313	.297	.003	.281	.106	.297	.001
Domestic animals	.171	.811	.364	.922	.697	.975	.700	.002	.599	.957	.189	.313		.700	.364	.313	.307	.409	.005
Pet animals	.839	.168	.764	.637	.771	.011	.597	.764	.016	.031	.619	.297	.700		.037	.208	.148	.331	.632
HW - before feeding	.082	.975	.052	.154	.333	.000	.764	.294	.844	.562	.096	.003	.364	.037		.798	.173	.103	.001
HW- before preparing food	.883	.925	.476	.083	.370	.241	.208	.511	.285	.561	.053	.281	.313	.208	.798		.717	.427	.651
Food Storage	.134	.938	.065	.165	.148	.679	.800	.376	.634	.352	.785	.106	.307	.148	.173	.717		.032	.179
Buying street food	.559	.700	.307	.637	.013	.459	.722	.307	.626	.213	.419	.297	.409	.331	.103	.427	.032		.005
Bacterial agents - diarrhea	.035	.279	.177	.002	.513	.019	.029	.012	.015	.216	.958	.001	.005	.632	.001	.651	.179	.005	

Age category, comprehensive mother's knowledge on cause of diarrhoea, number of children living in the house, floor and portico of the house, drinking water, latrine in the house, flies in the kitchen, domestic animals in the house, hand-washing by mothers before feeding children and buying food for children from street vendors had significant association with diarrhea causing bacteria.

Structural equation model

Based on the Pearson correlation matrix and studies on ssocioeconomic, environmental and behavioral factors on diarrhea causing bacteria, SEM was used to study the association between age category, comprehensive mother's knowledge on cause of diarrhoea, number of children living in the house, floor and portico of the house, drinking water, latrine in the house, flies in the kitchen, domestic animals in the house, hand-washing by mothers before feeding children and buying food for children from street vendors on diarrhea causing bacteria. In the regression, bacterial agents associated with infantile diarrhea was significantly association with mothers knowledge on cause of diarrhea (P=0.04), floor of the house and portico (p=0.022), latrine in the house (p=0.025), domestic animals in house (p=0.023) and buying food for children from street vendors (p=0.009).

The chi-square value of 4.135 with four degrees of freedom is non-significant at the 0.05 level: its *p*-value is 0.658. This finding suggests that model fits the data acceptably in the population. The model fit indices also provide a reasonable model fit for the structural model. Goodness of Fit index (GFI) obtained is 0.991. The Normed fit Index (NFI), Relative Fit index (RFI), Comparative Fit index (CFI) are 0.969, 0.714, 1.00 respectively. The significant Root mean Square Error of Approximation (RMSEA) was found (Table-10). Hence it is concluded that the proposed research model fits the data reasonably.

Table 1. Fit Indices of the Structural Model

S. No.	Fit statistics	Value
1	Chi-square	4.135
2	Degrees of freedom	6
3	Chi-square Probability level	0.658
4	Goodness of fit index(GFI)	0.991
6	Normed Fit Index (NFI)	.969
7	Relative Fit Index (RFI)	.714
8	Comparative Fit Index (CFI)	1.000
9	Root mean Square Error of Approximation (RMSEA)	.000

Conclusion

The highest rate of infection wasoccurred by buying food for children from street vendors. Among 48 isolates, all were resistant to ampicillin, rifampicin and erythromycin while susceptible to co-trimaxazole. 93.8 % of isolates were susceptible to ceftazidime followed by gentamicin (89.6%), cefuroxime (77.1%), amikacin (35.4%), imipenem (27.1%), ceftriaxone (25%), tetracycline (16.7%) and cefotaxime (14.6%). In the regression of structural equation model, bacterial agents associated with infantile diarrhea was significantly association with mothers knowledge on cause of diarrhea, floor of the house and portico, latrine in the house, domestic animals in house and buying food for children from street vendors. The findings of this study strengthen the parameters that infantile diarrhea infection is associated with mother's knowledge on cause of diarrhea, floor of the house and portico, latrine in the house, domestic animals in house and buying food for children from street vendors. Finally, structural equation modeling was used to analyze the data.

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