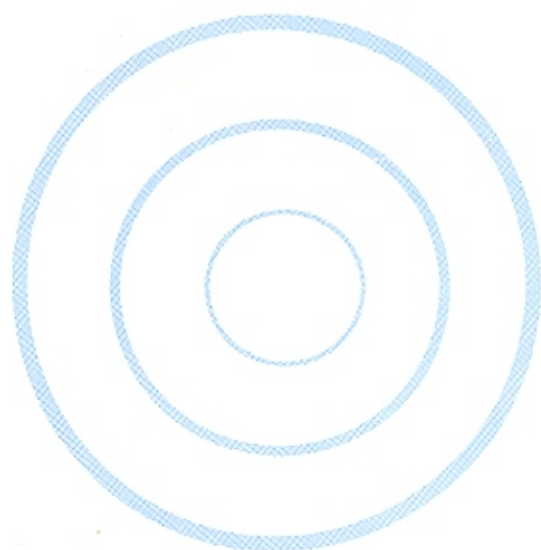




Volume 16  
Number 3  
September 1998

ISSN 0253-8768

JOURNAL OF  
**Diarrhoeal  
Diseases  
Research**



**INTERNATIONAL CENTRE FOR  
DIARRHOEAL DISEASE RESEARCH, BANGLADESH**

**Editor-in-Chief**

R Eeckels

E-mail: roger.eeckels@med.kuleuven.ac.be

**Deputy Editor-in-Chief**

GH Rabbani

E-mail: rabbani@icddr.org

**North American Editor**

M Bennis

E-mail: mbennis@es.nemc.org

**Managing Editor**

M Shamsul Islam Khan

E-mail: msik@icddr.org and disc@icddr.org

**Editors**MJ Albert  
AustraliaR Bairagi  
BangladeshMR Choudhury  
BangladeshG Fuchs  
USAHB Perry  
USAJL Ross  
USAP Vaughan  
UK**Editorial Advisory Board**KMA Aziz  
BangladeshMK Bhan  
IndiaSK Bhattacharya  
IndiaHJ Binder  
USARE Black  
USADJ Bradley  
UKKH Brown  
USAJ-P Butzler  
BelgiumRK Chandra  
CanadaRR Colwell  
USARI Glass  
USAWB Greenough III  
USAK Gyr  
SwitzerlandA Hall  
UKJR Hamilton  
CanadaFJ Henry  
USAJ Holmgren  
SwedenA Huq  
USAGT Keusch  
USAMA Khaled  
USAE Lebenthal  
USAD Mahalanabis  
IndiaJ Martinez  
SwitzerlandVI Mathan  
IndiaWH Mosley  
USALN Mutanda  
KenyaPDS Ocampo  
PhilippinesNF Pierce  
USAM Rahman  
BangladeshJ Rask-Madsen  
DenmarkR Robins-Browne  
AustraliaSC Sanyal  
IndiaR Suskind  
USAY Takeda  
JapanA Tomkins  
UKS Tzipori  
USAJA Walker-Smith  
UK**Publication and Printing**

MA Rahim and Talut Solaiman

**Cover Design**

Asem Ansari

**Editorial Secretary and Page Layout**

Mahbubul Hoque E-mail: jddr@icddr.org

**Subscription information**

Subscriptions to JDDR run for a full calendar year and include air mail postage. The 1998 and 1999 rates are as follows:

SAARC and other developing countries :	Institution	US\$ 60.00	Individual	US\$ 30.00
Developed countries :	"	US\$ 80.00	"	US\$ 40.00
Bangladesh :	"	Taka 500.00	"	Taka 500.00

Subscription orders may be placed through an agent or directly; 10% commission is allowed for subscription agents. All payments must be made in favour of the **International Centre for Diarrhoeal Disease Research, Bangladesh**. All correspondence regarding subscription should be addressed to: **Managing Editor, Journal of Diarrhoeal Diseases Research, International Centre for Diarrhoeal Disease Research, Bangladesh, Mohakhali, Dhaka 1212 (GPO Box 128, Dhaka 1000), Bangladesh.**



JOURNAL OF

# Diarrhoeal Diseases Research

Visit us at: <http://www.icddr.org>  
<http://www.icddr.org.sg>  
<http://www.cablemedia.com.sg/icddr>

# JOURNAL OF DIARRHOEAL DISEASES RESEARCH

Volume 16 Number 3

September 1998

## CONTENTS

### ORIGINAL PAPERS

- 173 **The Effect of Two Child-care Practices of Market Women on Diarrhoea Prevalence, Feeding Patterns and Nutritional Status of Children Aged 0-24 Months.** Henrietta N Ene-Obong, Ada C Uwaegbute, Christian U Iroegbu, and Uche V Amazigo
- 180 **Serogroups and Antimicrobial Susceptibility of Clinical Isolates of *Salmonella* Species from a Teaching Hospital in Kuwait.** Wafaa Y Jamal, T Pal, VO Rotimi, and TD Chugh
- 187 **Difficulties in Conducting Participatory Action Research to Prevent Diarrhoea in a Slum Area of Bangkok.** Sungkom Jongpiputvanich, Suriya Veeravongs, and Wathana Wonsekiartirat
- 194 **Diarrhoea in Children of Nigerian Market Women: Prevalence, Knowledge of Causes, and Management.** Folashade O Omokhodion, Adefunke Oyemade, Mynepalli kc Sridhar, Isaac O Olaseha, and Joshua F Olawuyi

### SHORT REPORT

- 201 **An Outbreak of Food Poisoning Associated with Restaurant-made Mayonnaise in Abha, Saudi Arabia.** Khalid Saeed Al-Ahmadi, Hassan E El Bushra, and Ali Saeed Al-Zahrani

### BIBLIOGRAPHY ON DIARRHOEAL DISEASES

- 205 Contents
- 207 Bibliography
- vi Author index
- ix Source index

### INFORMATION FOR CONTRIBUTORS

# The Effect of Two Child-care Practices of Market Women on Diarrhoea Prevalence, Feeding Patterns and Nutritional Status of Children Aged 0-24 Months

HENRIETTA N ENE-OBONG<sup>1</sup>, ADA C UWAEGBUTE<sup>1</sup>, CHRISTIAN U IROEGBU<sup>2</sup>, AND UCHE V AMAZIGO<sup>3</sup>

<sup>1</sup>Departments of Home Science and Nutrition, <sup>2</sup>Microbiology, and <sup>3</sup>Zoology, University of Nigeria, Nsukka, Enugu State, Nigeria

## ABSTRACT

A cross-sectional comparative study was conducted in seven markets in Enugu and Nsukka, Nigeria, to evaluate the child-care practices, occurrence of diarrhoea, feeding patterns and nutritional status among 506 and 157 children aged 0-24 months taken to the market (CTTM) by their mothers and those left at home (CLAH) respectively. A lack of a caretaker at home was the most common reason for taking children to the market. The majority (92%) of the caretakers at home were young (<20 years). There was no difference in the occurrence of diarrhoea in the last month between the CTTM (39%) and the CLAH (41%) groups ( $p>0.05$ ). However, there were differences in reported diarrhoea episodes between children aged 0-6 months and higher age classes ( $\chi^2=20.0$ ;  $p=0.003$ ). Very few children (0.8%) were exclusively breastfed. More CTTM (58%) were still being breastfed than the 42% of CLAH (OR=1.87; 95% C.I.=1.27-2.37;  $p<0.001$ ). Children cared for at home had a slightly better but non-significant ( $p>0.05$ ) anthropometric status as characterised by weight-for-age and height-for-age. There was no relationship between feeding patterns and diarrhoea.

*Key words:* Child nutritional status; Diarrhoea, Infantile; Infant feeding practices; Child care; Cross-sectional studies

## INTRODUCTION

It has often been emphasised that sound nutrition and primary healthcare programmes must take into account income-generating activities of mothers. This is because of the positive effect of women's own income on their children's health and nutritional status (1,2). However, it has also been stated that women's traditional tasks constitute a heavy workload, even in the absence of income-generating activities, and conflict with the need to breastfeed, carefully wean, or supervise infants and young children (3). For poor urban women, market responsibilities do not diminish their need to provide for crucial aspects of home management, such as childcare and food preparation. Some observers and researchers feel that urban work is quite incompatible with proper childcare (4-6).

Women have developed strategies that allow them to be economically productive while coping with the demands of childbearing and child care. These include dependence on traditional support systems, such as choosing flexible working time, and obtaining the help of surrogate mothers, including older siblings. Sometimes, these other caretakers are unable to properly look after young children, thus leaving especially infants vulnerable to poor diet and infections (7). Another strategy is to take the child to work. In Malaysia, 32% of women in sales and production and 14% of those in service-sector jobs were accompanied to work by their children aged less than 10 years (5). The market environment, however, with its prevailing unsanitary

Correspondence and reprint requests should be addressed to: Dr. HN Ene-Obong

conditions and overcrowding could be dangerous for the child. In addition, women engaging in buying and selling may not be able to give close attention or supervision to their children (3). Depending on the number of hours spent in the market, infant foods may be poorly prepared, obtained, or handled. All these are potential hazards to children in the market.

The purpose of our study was to evaluate whether children taken to the market workplace (CTTM group) were more or less likely to have had a recent episode of diarrhoea than those who were left at home (CLAH group) when their mothers go to the market workplace. We conducted a cross-sectional study to compare in the two groups the proportion of children who had diarrhoea in the one month before the mothers' interview. One month was chosen to minimise recall bias. In the two groups of children the feeding pattern and nutritional status, which are possible risk factors (8,9), were compared.

#### SUBJECTS AND METHODS

A cross-sectional comparative study was conducted in 7 markets in Enugu and Nsukka, Enugu State, Nigeria. These two towns were selected, because they each have reasonably large daily markets with 1000 to 5000 sellers. They have permanent and temporary stalls and open areas with no superstructures. Public conveniences, such as toilets, are often inadequate and far away from most users. Due to a lack of service provision by the local government councils, refuse is not regularly collected and evacuated. Thus, in most markets, refuse heaps cover large areas. It is in this environment that most women and their children are found, with the children crawling or toddling around while their mothers are busy attending to their customers.

Enugu is an old city, an administrative capital for over 50 years and important for its coal mines. Over the years, several communities have merged to produce what is Enugu today with a population of 0.5 million. About half the city has no regular supply of potable water and depends on water tankers to supply water from sources of questionable sanitation. There are six daily markets located in different areas of Enugu. Although all classes of people buy in these markets, the market women are predominantly of low socioeconomic status. Among these six markets, only Ogbete Main Market (located in the city centre) has a barely adequate water supply.

Additionally, this is the only market that is paved and of a moderate hygienic standard.

Nsukka is 72 km north of Enugu. Unlike Enugu, its urbanisation is recent, following the establishment of the University of Nigeria in 1960. It is smaller than Enugu, with a population of 218,000. There is only one market serving the town. Again the traders are predominantly of low socioeconomic class. The public water supply is better than Enugu but still not good or reliable. Most households depend on water tankers supplying water for domestic use.

#### Sample population and sampling technique

Preliminary visits were made to local government authorities to seek permission to carry out research in the markets. Permission was also sought and obtained from the Chairpersons of the various market associations.

A sample size of 700 (350 for the CTTM group and 350 for the CLAH group) was calculated based on the assumptions made on the key variables of the study (diarrhoea episodes, feeding patterns, and nutritional status). A list of all market women with children aged 0-24 months was drawn up in each market with the help of the market authority personnel. For mothers who had two children aged less than 24 months, only the younger one was included in the study. Thus, the mothers were classified based on where their children were cared for and mothers were the units of analysis. The sample frame for mothers who took their children to market (WTCM) was 506 (76%), and it was 157 (24%) for those who left their children at home (WLCH). Since the latter group was not up to 350, we included everyone in that group in the study. To minimise bias, we also included all the mothers who took their children to the market work place.

A structured interview form was designed, validated and pre-tested before administration. All mothers were interviewed in the local language by trained research assistants. They were interviewed on their socioeconomic characteristics, infant-feeding practices, and their infants' diarrhoea prevalence and management. The interviews for both the groups were done in the market place during the same period (June 1993). The anthropometric status of the children was assessed by taking measurement of heights and weights. These measurements were taken in the market for the CTTM and at home for the CLAH. Height or length (cm) was

measured with a non-stretchable tape mounted on a wooden bar. For the weight (kg), the mothers or caretakers were weighed first on a sensitive bathroom scale, and their weights noted. They were weighed again carrying the children. The weights of the children were obtained by subtraction.

### Analysis of data

Data were coded, and entered into a computer and analysed using the Epi Info Programme, version 5 (Centers for Disease Control and Prevention, Atlanta, Georgia, USA). Range and consistency checks were made on the data. The data obtained for the two groups of children were compared using percentages of the frequency distributions, chi-square ( $\chi^2$ ) tests for categorical variables, and Kruskal-Wallis and *t*-tests for continuous variables. Multiple regression analyses were used for controlling for age when comparing outcome variables between the groups. Anthropometric status was derived by computing weight-for-age (WAZ), height-for-age (HAZ) and weight-for-height (WHZ) z-scores using the National Center for Health Statistics (NCHS) references (10).

## RESULTS

### Characteristics of the market women, their children and caretakers

The characteristics of the WTCM and WLCH groups of women were statistically similar in terms of age and educational attainment (Table I). About 98% of the two groups of women were married. The WTCM group had a lower parity ( $\chi^2=9.70$ ;  $p=0.008$ ) and spent less hours in the market ( $\chi^2=8.05$ ;  $p=0.02$ ) than the WLCH group.

There was a significant difference in the ages of the two groups of children ( $\chi^2=17.05$ ;  $p<0.001$ ) (Table II). There were more infants (49%) among CTTM compared to CLAH (35%). The mean (SD) age at which mothers started bringing their children to the market was 6 (3) months. When asked at what age they would stop bringing their child, the average age given was 30 (9) months. The most frequently mentioned reasons for bringing a child to the market were: because there was nobody to look after the child at home (73%), while all mothers who left their children at home did so, because they had people to look after them (80%). The majority of the caretakers were other family members. About 19% of these were aged less than 10 years, while 73% were aged 10-19 years (Table II).

**Table I:** Characteristics of the market women with children aged 0 to 24 months

	WTCM (n = 506) (%)	WLCH (n = 157) (%)
<b>Mothers' age group (years)</b>		
24 and below	118 (23)	30 (19)
25-29	191 (38)	60 (38)
30-34	118 (23)	30 (19)
35 and above	55 (11)	24 (15)
No response	24 (5)	3 (2)
Total	506 (100)	157 (100)
$\chi^2$ (first 4 rows)=3.01; df =3; p=0.39		
<b>Educational level</b>		
No formal schooling	46 (9)	14 (9)
Primary school (1-6 years)	224 (44)	70 (45)
Secondary school (7-12 years)	198 (39)	61 (39)
Others	35 (7)	12 (8)
No response		0
Total	506 (100)	157 (100)
$\chi^2$ (first 4 rows) = 0.1; df = 3; p=0.99		
<b>Marital status</b>		
Married	496 (98)	150 (96)
Others (single, widowed)	10 (2)	7 (4)
Total	506 (100)	157 (100)
$\chi^2=2.96$ ; df=1; p=0.09		
<b>Parity</b>		
1 to 3	285 (56)	69 (44)
4 to 6	187 (37)	70 (45)
7 to 12	29 (6)	17 (11)
No responses	5 (1)	1 (1)
Total	506 (100)	157 (100)
$\chi^2$ (first 3 rows) =9.70; df=2; p=0.0078		
<b>Numbers of hours spent in market per day</b>		
1 to 5	11 (2)	4 (3)
6 to 10	346 (68)	83 (53)
11 to 15	97 (19)	43 (27)
No responses	52 (10)	27 (17)
Total	506 (100)	157 (100)
$\chi^2$ (first 3 rows)=8.05; df=2; p=0.018		

**Table II:** Characteristics of children of market women and caretakers

Children's age (months)	CTTM (n=506) (%)	CLAH (n=157) (%)
	1 to 6	53 (10)
7 to 12	195 (39)	44 (28)
13 to 18	151 (30)	45 (29)
19 to 24	105 (21)	57 (36)
Not given	2 (0.4)	0
Total	506 (100)	157 (100)
$\chi^2$ (first 4 rows)=17.05; df=3; p<0.001		
Caretakers' type (CLAH)		
Household help		35 (21)
Mother/mother-in-law		15 (9)
Mother's younger sister		
Older children		49 (29)
Husband		1 (1)
Total		167* (100)
*Total more than 157 due to multiple responses		
Caretakers' age group (years) (CLAH)		
<10		31 (19)
10 to 19		123 (74)
20 to 60		13 (8)
Total		167* (100)
*Total more than 157 due to multiple responses		

**Table III.** Reported number of episodes of diarrhoea in the last one month in children of market women

Frequency	CTTM (n=506) (%)	CLAH (n=157) (%)
Once	151 (30)	49 (31)
Two times	24 (5)	4 (3)
Three times	10 (2)	7 (4)
>3 times	14 (3)	4 (3)
No diarrhoea	307 (61)	93 (59)
Total	506 (100)	157 (100)
$\chi^2$ =4.38; df=4; p=0.366		

**Table IV.** Feeding patterns used by the market women

		WTCM n=506 (%)	WLCH n=157 (%)
A	Ever breastfed	504 (99.6)	156 (99.4)
B	Duration of breastfeeding (median)	15 months	15 months
C	Feeding pattern:		
	Breast-milk only	4 (1)	0
	Breast-milk + formula	7 (1)	3 (2)
	Formula + weaning food	22 (4)	4 (3)
	Weaning food only	189 (38)	86 (55)
	Breast-milk + weaning food	209 (41)	50 (32)
Total		504 (100)	157 (100)
$\chi^2$ =16.70; df=5; p=0.0051			
D	Still breastfed	293 (58)	67 (43)
	Fully weaned*	211 (42)	90 (57)
Total		504 (100)	157 (100)
* $\chi^2$ =11.54; df=1; p<0.001; OR for fully weaned (CTTM)=0.54; 95% C.I. 0.37-0.78			

**Table V.** Anthropometric status of children of market women [mean z-score (SD)]

Variables	CTTM	CLAH	p value
Height-for-age (HAZ)	-1.34 (1.76)	-1.20 (2.07)	>0.05
Weight-for-age (WAZ)	-0.69 (1.50)	-0.46 (1.72)	>0.05
Weight-for-height (WHZ)	0.30 (1.82)	0.45 (1.93)	>0.05

### Diarrhoea occurrence

There was no significant difference in the occurrence of diarrhoea in the last one month between the CTTM (39%) and CLAH (41%) (Table III). When adjusted for age, there was still no difference in the occurrence of diarrhoea between the two groups. All the women in the two groups were categorised into two educational levels: those with not more than primary education and those with secondary education or more. A negative association between diarrhoea occurrence and mothers' education was found. About 51% of the children of mothers with secondary education or more had diarrhoea compared to 49% of the children of mothers with not more than primary education (OR=1.40; 95% confidence interval (C.I.)=1.01 to 1.94; p=0.03).

### Feeding patterns

Table IV shows that nearly all mothers reported breastfeeding, or having breastfed their children at some point in time. Still, very few children were exclusively breastfed (<1%). When asked how long they would normally breastfeed, mothers in each group gave a median duration of 15 months. The most common feeding patterns (both groups joined) were breast-milk combined with weaning food (39%) or weaning food only (42%). Classifying feeding pattern into two groups; those still being breastfed and those fully weaned food, a significant difference was found between the CTTM and the CLAH. More CTTM (58%) were still being breastfed compared to CLAH (42%). Comparing the children left at home with those taken to the market, the latter had an odds ratio for being fully weaned of 0.54, with 95% C.I. of 0.37 to 0.78 ( $p < 0.001$ ).

Weaning food was mainly a maize gruel pap with or without sugar, milk, ground crayfish, and soybean powder. About 75% and 90% of the WTCM and WLCH respectively gave pap in one form or the other. It was supplemented with the family diets made from starchy roots, tubers, cereals, and legumes. About 72% of the WLCH compared to 61% of the WTCM used these diets. Commercial cereals or legumes with cereals products were less popular in both the groups. However, no significant difference was found between feeding pattern and diarrhoea prevalence ( $p > 0.05$ ).

### Nutritional status

Anthropometric data were obtained from 362 (72%) children taken to the market and 108 (69%) children left at home. Table V shows that there was a tendency for the CTTM to have a lower anthropometric status than those left at home, although the differences were not statistically significant ( $p > 0.05$ ; Kruskal-Wallis test for two groups and *t*-test). However, when the data were adjusted for age, the differences in the mean height-for-age, weight-for-age and weight-for-height z-scores (HAZ, WAZ, and WHZ) increased to 0.21, 0.32, and 0.25 respectively, but only the WAZ was almost statistically significant ( $p = 0.06$ ). Multiple regression analysis showed age rather than environment to be the major determinant of nutritional status of the children with particular reference to WAZ and WHZ ( $p < 0.05$ ).

### DISCUSSION

The general objective of this study was to compare the effect of two child-care practices of market women on diarrhoea prevalence, feeding practices and nutritional status of children aged 0-24 months. Generally, over 75% of the market women with children of that age bring them to the market. Taking a child to the market was related to the absence of caretaker(s) in the home rather than to the mother's desire to take care of the child herself. It is, therefore, likely that these women would leave their children at home if they had caretakers. In a study conducted in the 1970s in Lagos, Nigeria, only about 19% of working mothers (mostly market women or petty traders) took their youngest child to work (11). This may indicate that, about 25 years later, working mothers no longer enjoy the traditional child-care institution, such as members of the extended family, including older children. This can tentatively be attributed to recent migration of the mothers from rural to urban areas with a weakening of the support provided by extended families. A look at types and ages of the caretakers shows that they are mainly children of school age and suggests the poor quality of care they provide. As more children go to school, the proportion of children taken to the market is likely to increase in the future unless adequate provisions for the care of pre-school children are made.

Taking a child to the market can be seen as advantageous in the sense that it gives mothers the opportunity to continue to breastfeed and look after the child while at work. Thus, one of the assumptions in this study is that children taken to the market would be healthier than those left at home. In this study, however, diarrhoea prevalence in the past one month was similarly high for both groups of children ( $p > 0.05$ ). The children also were similarly malnourished in terms of WAZ and HAZ-scores (Table V). Yet, children cared for at home were slightly better off with respect to two of the anthropometric indicators (WAZ and HAZ). The WAZ index, an indicator of the general state of nutrition, showed the greatest difference. Even though the children's care was different, all mothers were working outside the home, the majority of them (>80%) spending more than 6 hours in the market. Several studies have demonstrated an adverse impact of mothers' work outside the home on the health and development of their infants and pre-school children (12,13). This study tends to support this view. A busy mother, irrespective of her



occupation, may have little time to feed her child adequately. Likewise, a young caretaker may also lack the necessary knowledge to properly take care of a infant or toddler, despite the provisions made by the mother before leaving for her market workplace.

Huttley *et al.* (8) have shown that risk factors for diarrhoea in Nigerian children include lower socioeconomic status, poor personal and domestic hygiene, and feeding methods other than exclusive breastfeeding in the early months of infancy. The socioeconomic characteristics of our two groups of mothers were similar. The educational attainment of the women does probably not provide them with enough training and skills for more lucrative and formal employment. The higher rate of diarrhoea among children of mothers with secondary education is surprising. There is, however, conflicting evidence in the literature on this issue. While some studies have shown a positive association between diarrhoea in children and illiteracy of their mothers, others have not found any association between mothers' education and diarrhoea prevalence (14). The higher prevalence of diarrhoea in children of mothers with secondary education when compared with those with lower education could have arisen from under-reporting or poor diagnosis of diarrhoea by the latter group. It should be noted that most mothers trade in very unsanitary environments. It is in this environment that they leave their children to crawl or toddle around unsupervised while they are busy attending to their customers. For women who leave their children at home, the occurrence of diarrhoea would also depend on the limited competence of the caretakers and the sanitary conditions within the household environment. This type of observation has been made in rural Iran (13).

Infant-feeding practices of market women did not differ from that of most Nigerian women of similar socioeconomic status and culture (15-17). Even though, at the time of study, about 18% of the children were still younger than 6 months of age, less than 1% were exclusively breastfed. The difference in feeding patterns between the two groups can be accounted for by the age differences. Children taken to the market were younger than those left at home, and so more of them were still being breastfed. There was no association between feeding pattern and diarrhoea occurrence in these children. The median duration of breastfeeding by these

women is 15 months. This is lower than the 24 months or more recommended by WHO and UNICEF, emphasising the need for appropriate supplementary foods. The weaning foods used by these market women were based on maize gruel, starchy family meals prepared from roots, tubers, cereals and legumes, which have been shown to be low in energy density (17,19).

It is not surprising then that these children were poorly nourished. The link between infections, particularly of the gastrointestinal tract (20), and malnutrition is well established (9). Diarrhoea will impair weight as well as height gain (21). The poorer nutritional status of the CTTM suggests that these children may have been poorly fed or may have had more infections. Yet, we have found no significant difference in diarrhoea rates between children taken to the markets and those cared for at home. The reasons for this may include response bias or diagnosis bias and requires further investigation. However, this finding may also indicate a high prevalence of diarrhoea, whether children are taken to the market or not. That women who took their children to the market would rather leave them at home if they had caretakers suggests that having their children with them imposes some constraints on their market activities and, therefore, affects the quality of care they can offer to their children. On the other hand, since the majority of caretakers at home are young, there is also doubt as to the quality of care they can provide. There is, therefore, a need to empower these women in the areas of quality child-care practices. This calls for the establishment of health posts in Nigerian markets. Such posts would be used for the promotion of appropriate infant-feeding practices, growth monitoring, distribution of oral rehydration solution and cater for other special needs of the children of market women.

#### ACKNOWLEDGEMENTS

Financial and technical support for this research was provided by the Applied Diarrheal Disease Research (ADDR) project at Harvard University under a cooperative agreement with the U.S. Agency for International Development. We especially thank Sharon Huttly of the London School of Hygiene & Tropical Medicine and Dr. Fitzroy Henry, Regional Advisor, ADDR, for their invaluable assistance and suggestions from the development of the grant proposal to the preparation of this manuscript. We are also grateful to the market women for their cooperation in this study and to the field workers for their dedication.

## REFERENCES

1. Kumar S. Impact of subsidized rice on food consumption and nutrition in Kerala. Washington, D.C.: International Food Policy Research Institute, 1979. (Research report no. 5).
2. Kahn S. Evaluation report on training programme for women group leaders of Grameen Bank Project. Dhaka: UNICEF, 1982.
3. Rogers BL, Youssef N. The importance of women's involvement in economic activities in the improvement of child nutrition and health. *Food Nutr Bull* 1988;10:32-4.
4. Popkin BM, Bilsborrow RE, Akin JS, Yamamoto ME. Breastfeeding determinants in low-income countries. *Med Anthropol* 1983;7:1-31.
5. Davanzo J, Lee DLP. The compatibility of childcare with market and non-market activities: preliminary evidence from Malaysia. In: Buvinic M, Lycette MA, McGreevey WP, editors. Women and poverty in the third world. Baltimore: University Press, 1983.
6. McGurie JS, Popkin BM. The zero-sum game: a framework for examining women and nutrition. *Food Nutr Bull* 1988;10:27-32.
7. Hossein G. Women, Food and nutrition issues in need of a global focus. In: Women and nutrition ACC/SCN symposium report. New York: United Nations, 1990:6.
8. Huttley SRA, Blum D, Kirkwood BR, Emeh RN, Feachem RG. The epidemiology of acute diarrhoea in a rural community in Imo State, Nigeria. *Trans R Soc Trop Med Hyg* 1987;81:865-70.
9. Scrimshaw NS, Taylor CE, Gordon JE. Interactions of nutrition and infection. *Am J Med Sci* 1959;237:367-403.
10. National Center for Health Statistics. Monthly vital statistic reports. Health examination survey data, NCHS charts, 1976. U.S. Department of Education and Welfare.
11. Fapohunda ER. Characteristics of women workers in Lagos: data for consideration by labour market theorists. *Labour Soc* 1978;3:156-71.
12. Gopaldas T, Patel P, Bakshi M. Selected socioeconomic, environmental, maternal and child factors associated with the nutritional status of infants and toddlers. *Food Nutr Bull* 1988;10:29-34.
13. Rabiee F, Geissler C. The impact of maternal workload on child nutrition in rural Iran. *Food Nutr Bull* 1992;14:43-8.
14. Mazrou MYY, Aziz KMS, Khalil M. Association of parents' education and father's occupation with prevalence of diarrhoea among children less than five years of age in Saudi Arabia. *J Diarrhoeal Dis Res* 1991;9:301-4.
15. Isenalumbe TE, Oviawe V. Pre-lacteal feeds and breast-feeding problems. *Indian J Paediatr* 1987;54:89-96.
16. Ijere NJ. Patterns of infant feeding and nutritional status of infants in Nsukka. Nsukka Department of Home Science and Nutrition, University of Nigeria. (Dissertation).
17. Uwaegbute AC. Weaning practices and weaning foods of the Hausa, Yorubas and Ibos of Nigeria. *Ecol Food Nutr* 1990;26:139-53.
18. Akinrele IA, Bassir. The nutritional value of "Ogi" - a Nigerian infant food. *J Trop Med Hyg* 1967;70:270-80.
19. Eka OU. Nutritional value of Tuwo-shinkafa Da Miyan-Taushe: a traditional rice meal of the Hausa of Northern Nigeria. *Nigerian J Nutr Sci* 1982;3:87-90.
20. Mata L. Diarrhoeal disease as a cause of malnutrition. *Am J Trop Med Hyg* 1992;47:S16-27.
21. Guerrant RL, Schorting JB, McAuliffe JF, De Souza MA. Diarrhea as a cause and as effect of malnutrition: diarrhea prevents catch-up growth and malnutrition increases diarrhea frequency and duration. *Am J Trop Med Hyg* 1992;47:S28-35.

# Serogroups and Antimicrobial Susceptibility of Clinical Isolates of *Salmonella* Species from a Teaching Hospital in Kuwait

WAFAA Y JAMAL, T PAL, VO ROTIMI, AND TD CHUGH

*Department of Microbiology, Mubarak Al-Kabeer Hospital and Faculty of Medicine,  
Kuwait University, P.O. Box 24923, Safat 13110, Kuwait*

## SUMMARY

*Salmonella* strains isolated in a teaching-cum-general hospital in Kuwait during 1990-1993 and 1996 were analysed to determine the trend in the prevalence of the serogroups and their changing pattern of susceptibility. The records were reviewed for all the 661 isolates encountered during these periods. The most prevalent serogroup in both children and adults was serogroup B, followed by serogroup C and D. A sizeable proportion of the strains were resistant to first-line drugs. About 39% of the isolates were resistant to ampicillin, 17% to co-trimoxazole, 13% to chloramphenicol, and 15% to cephalothin. The majority were, however, susceptible to the other drugs with low to very low resistance rates: 7% to amoxicillin/clavulanic acid, and 0.3% to cefotaxime. All the strains were susceptible to ciprofloxacin. In all, resistant strains were more prevalent among children than adults.

*Key words: Salmonella; Salmonella infections; Gastroenteritis; Microbial sensitivity tests; Drug resistance, Microbial*

## INTRODUCTION

Acute gastroenteritis is an important cause of morbidity and mortality in children as well as adults. Although the causative agents depend on the patients' age, predisposing conditions and geographical area, *Salmonella* spp. are an important cause of acute gastroenteritis (1-8). The main features of *Salmonella* infections are diarrhoea, with sometimes mucoid and bloody stools, dehydration, and fever. Although the condition is mostly self-limiting and does not require antimicrobial therapy, admission to hospital for intravenous rehydration may be required. When *Salmonella* spp. become invasive and produce systemic symptoms, antibiotics are required, particularly in the critically ill patients with suspected septicæmia.

*Salmonella* spp., resistant to the so-called first-line antimicrobial agents, i.e. ampicillin, chloramphenicol,

and co-trimoxazole, are widespread all over the world, especially in the developing countries where the rate of diarrhoeal disease is high (3,9-11). Typhoidal and non-typhoidal *Salmonellae* spp., resistant to newly introduced antibiotics, have recently been reported (12,13), which is an added burden to the ever increasing incidence of antibiotic-resistant bacteria in general (14). The concern this raises is illustrated by the recent introduction in the USA of a programme for surveillance of antimicrobial resistance in *Salmonella* spp. isolated from animals and humans (15). Conceivably, such a programme may be needed in other countries, particularly those where consumption of antibiotics is very high.

---

Correspondence and reprint requests should be addressed to: Dr. Wafaa Y Jamal  
Department of Microbiology, Faculty of Medicine  
Kuwait University, P0 Box 24923, Safat 13110, Kuwait  
Email: Vincent@hsc.kuniv.edu.kw

So far as we know there has been no report on the distribution of the serogroups and antibiotic resistance pattern of *Salmonella* spp. isolated from Kuwait. To demonstrate any trend in the rate of isolation of different serogroups and the resistance pattern of *Salmonella* isolates in our hospital, we studied bacteriological records collected in 1990, before the Gulf War invasion, during the invasion of 1991, two years immediately post-invasion, and during a relatively calm year, 1996. In this study, we report on the pattern of antibiotic resistance, as well as the prevalent serogroups of the *Salmonella* isolates from a teaching-cum-general hospital in Kuwait, which serves about 60% of the population of Kuwait. The 1997 population estimate is 1,800,000, with about 41% Kuwaiti and 59% non-Kuwaiti. The urbanisation rate is 97%, and the 1995 infant mortality was 11.1 per thousand.

#### MATERIALS AND METHODS

This study was conducted on 661 *Salmonella* strains isolated from the faecal and blood samples of inpatients and outpatients with diarrhoea, fever, or both diarrhoea and fever, managed at the Mubarak Al-Kabeer Hospital, Kuwait, over a 5-year period. The samples were obtained from children (aged 0-12 years) and adults. Blood samples were cultured using the conventional method and a Bactec 9240 automated machine (Becton-Dickinson, MD, USA). Stools were inoculated directly onto a series of selective and differential media, including MacConkey (Oxoid, Basingstoke, UK), Desoxycholate agar (DCA; Oxoid) and Selenite F broth (Oxoid); for half of the period in 1996, xylose lysine desoxycholate (XLD) agar (Difco Laboratories, DT, USA) was added to the battery of culture media. Inoculated media were incubated in air at 37 °C for 24 hours. After overnight incubation, the Selenite broth was subcultured onto another set of MacConkey and DCA or XLD and incubated for 24 hours. Representative non-lactose-fermenting colonies were further subcultured on triple sugar iron (TSI) agar slants from where suspected isolates were identified by the automated Vitek card system (Bio-Merieux Vitek, Inc., Hazelwood, MO, USA) and the API 20E (BioMerieux, France). Identified *Salmonella* isolates were then serogrouped using specific grouping antisera (Wellcome Diagnostics, Dartford, UK). Antibiotic susceptibility testing was performed using an automated Vitek machine with Gram-negative bacteria cards, which gave MIC results and interpretation of the results as resistant or susceptible according to the

breakpoints for each antibiotic. On a few occasions, susceptibility was done manually by the Kirby-Bauer method according to the procedure recommended by the National Committee for Clinical Laboratory Standards (NCCLS) (16), using a reference strain of *Escherichia coli*, ATCC 25922 as control. When susceptibility testing was done manually, antibiotics with the following disc contents were tested: amikacin (30 mg; BBL), ampicillin (10 mg; BBL), amoxicillin/clavulanic acid (30 mg; Oxoid), cefotaxime (30 mg; BBL), ceftriaxone (30 mg; BBL), cephalothin (30 mg; BBL), chloramphenicol (10 mg; BBL), ciprofloxacin (5 mg; BBL), co-trimoxazole (25 mg; BBL), gentamicin (10 mg; BBL), imipenem (10 mg; Oxoid), and piperacillin (64 mg; BBL). Susceptibility and resistance were delineated using the breakpoint and zone size criteria set by the NCCLS (16).  $\beta$ -Lactamase production was detected by the use of Cefinase strips (BBL, Becton-Dickinson MS, Cockeysville, USA).

#### Statistical analysis

The data were analysed statistically using the chi-square test with Yates correction showing 95% confidence intervals (C.I.).

#### RESULTS

A total of 661 isolates were analysed for the 5-year period from 1990 through 1993 and 1996. Repeat isolates from the same patients were excluded. Of the 661 isolates, an overwhelming majority, 515 (78%), were from children, while 146 (22%) were from adults ( $p < 0.0001$ ). Of the 661 isolates, 388 (59%) were from male patients and 273 (41%) from females. The vast majority, 624 of 661 (94%), were from stool specimens, 24 (4%) were blood isolates, and the remaining 13 (2%) were from both stool and blood. A total of 147, 60, 148, 121 and 185 strains were isolated in 1990, 1991, 1992, 1993 and 1996 respectively. The low figure of 60 represents the isolates during the Gulf War year 1991.

Table I shows the distribution of the *Salmonella* serogroups. Three serogroups, B, C and D, represented about 88% of all isolates. However, the predominant serogroup in both the age groups was B, accounting for 44% of the total isolates, followed by C (26%) and D (18%). Serogroup B remained remarkably consistent, by far the leading prevalent serogroup in adults and children over the 5 years. There was no change in the order of frequency of isolation of serogroup C and D for each

year; each maintaining second and third positions respectively throughout the 5 years. Of the 118 group D isolates, only 15 were *S. typhi*; 13 of these were from blood culture. This represented an average of 3 isolates per year. Serogroups H, K N, O and Q, when encountered, were isolated exclusively from children.

**Table I.** Distribution of *Salmonella* serogroups among the isolates. Absolute numbers with column percentages and row percentages

Serogroup	Children	Adults	Total (%)	
B	226 (44%) [78%]	63 (43%) [22%]	289 [100%]	(44%)
C	131 (26%) [76%]	42 (28%) [24%]	173 [100%]	(26%)
D	93 (18%) [79%]	25 (17%) [21%]	118 (100%)	(18%)
E	23 (4%) [72%]	9 (6%) [28%]	32 [100%]	(5%)
G	18 (4%) [86%]	3 (2%) [14%]	21 [100%]	(3%)
H	1 (0.2%)	0	1	(0.2%)
K	2 (0.4%)	0	2	(0.3%)
N	1 (0.2%)	0	1	(0.2%)
O	1 (0.2%)	0	1	(0.2%)
Q	2 (0.2%)	0	2	(0.3%)
R	0	1 (0.7%)	1	(0.2%)
S	0	1 (0.7%)	1	(0.2%)
Arizona	3 (0.6%)	1 (0.7%)	4	(0.6%)
Ungroupable	12 (2%)	3 (2%)	15	(2%)
Subtotal H to end	22 [79%]	6 [21%]	28 [100%]	(4%)
Total	513 (100%) [78%]	148 (100%) [22%]	661 (100%) [100%]	

The resistance pattern of the isolates is shown in Table II. All were susceptible to ciprofloxacin and imipenem. Less than 1% were resistant to cefotaxime and amikacin, while piperacillin, gentamicin, and amoxicillin/clavulanic acid also demonstrated very good activities with resistance rates of 5%, 1% and 7% respectively. Ampicillin had the least activity with 39% resistant isolates, followed by co-

trimoxazole (17%), cephalothin (15%), and chloramphenicol (13%). Table II also shows that the percentage of isolates, resistant to any of the antibiotics tested, except cefotaxime, was higher in children than in adults. The statistical analysis demonstrated a highly significant difference, at 95% C.I., between the number of children and adults with resistant strains. These differences in resistant isolates with ampicillin, co-trimoxazole, cephalothin, chloramphenicol, and amoxicillin/clavulanic acid were statistically significant,  $p < 0.0001$ ,  $p < 0.0001$ ,  $p < 0.001$ ,  $p < 0.001$  and  $p < 0.05$  respectively. In particular, the difference between the ampicillin- and co-trimoxazole-resistant isolates from the two age groups was highly significant. The 15 isolates of *S. typhi* were susceptible to all the antibiotics, except ampicillin, co-trimoxazole, and cephalothin with resistance rates of 13%, 27% and 13% respectively.

The figure shows the yearly percentages of resistant isolates to the main drugs used in the management of systemic salmonellosis. Rather than continue to increase, the general antibiotic resistance rates reached a top in 1992 and has decreased since. The resistance to ampicillin was high, 39% in 1990, reaching 50% in 1992, but gradually came down to 28% in 1996. Gentamicin resistance came down from 10% in 1990 to 1% in 1996. Chloramphenicol resistance increased from 11% in 1990 to 17% and 16% in 1991 and 1992 respectively, to return to 12% in 1996. The resistance rate to co-trimoxazole has remained consistently high for the 5-year period; from 18% in 1990 and 1991 to 21% in 1993 and down to 14% in 1996. Resistance to cephalothin also remained consistently high throughout the 5-year study period; 20% in 1990, 9% in 1991, 18% in 1992, 10% in 1993, and 16% in 1996, with an overall rate of 15%.

Of the 661 isolates, 238 (36%) were resistant to two or more antibiotics. All of these were resistant to ampicillin plus one or more other antimicrobials. Of these 238 multidrug-resistant isolates, 6% were resistant to amoxicillin/clavulanic acid and 13% to chloramphenicol; nine (4%) were resistant to five different antibiotics, namely ampicillin, amoxicillin/clavulanic acid, co-

trimoxazole, chloramphenicol, and cephalothin. The vast majority (155/238; 65%) of these multidrug-resistant isolates belonged to serogroup B, including five of the nine that were resistant to five antibiotics.

results of similar studies from Saudi Arabia (10) and Hong Kong (3). That salmonellosis is more frequent in children than in adults is well known. However, the present study shows a much higher than usual proportion of children's isolates compared with the experience in nearby Saudi Arabia where the prevalence is 60% and 40% in children and adults respectively (10). The Hong Kong experience where a preponderance of serogroup B was also isolated (3) is comparable to ours. In Hawaii, Yamamoto *et al.* (17) reported a high isolation rate (39%) of serogroup E, a serogroup not so common in our patients and neither in neighbouring Saudi Arabia (10). Serogroup D represented about 18% of our isolates; only a few of these were *S. typhi*. Like the present report, similar findings have been reported in the two previous studies from Saudi Arabia and Hong Kong, but differ from the report of a similar study from Spain (18) where serogroup D was the dominant isolate, followed by serogroup B and C. This clearly indicates that there is a geographical difference in the distribution of *Salmonella* serogroups around the world.

**Table II.** Antibiotic resistance pattern of the 661 *Salmonella* isolates in children and adults

Antimicrobials	No. (%) of resistant isolates in			p value
	Children (n=513)	Adults (n=148)	Total (n=661)	
Ampicillin	242 (47)	16 (11)	258 (39)	<0.0001
Co-amoxiclav*	43 (8)	3 (2)	46 (7)	<0.05
Cephalothin	85 (17)	14 (10)	99 (15)	<0.001
Cefotaxime	0 (0)	2 (1)	2 (0.3)	
Piperacillin	27 (5)	6 (4)	33 (5)	>0.05
Ciprofloxacin	0 (0)	0 (0)	0 (0)	
Chloramphenicol	78 (15)	8 (5)	86 (13)	<0.001
Co-trimoxazole	104 (20)	8 (5)	112 (17)	<0.0001
Amikacin	6 (1)	1 (0.7)	7 (1)	>0.05
Gentamicin	7 (1)	0 (0)	7 (1)	>0.05
Imipenem	0 (0)	0 (0)	0 (0)	

\*Co-amoxiclav = amoxicillin/clavulanic acid

## DISCUSSION

This study shows a decrease in the number of *Salmonella* spp. isolates during the Gulf War year. This stands to reason as there were fewer people, mainly Kuwaiti nationals, present in this country for the greater part of 1991. As soon as nationals and expatriates started to return and the hospitals were rehabilitated, the numbers of isolates increased. In 1996, with the situation stabilised and all the hospitals and clinics fully functional, more *Salmonella* spp. were noted than in any of the previous pre-invasion years.

The data also show that the vast majority of the isolates were from children and that nearly one-half belonged to serogroup B (44%). Following this serogroup at some distance were serogroup C and serogroup D. This trend appears concordant with the

That only 15 (2.3%) of the 661 *Salmonella* spp. were *S. typhi* should not come as a surprise, because non-typhoidal *Salmonellae*, unlike *S. typhi* and *S. paratyphi*, are widely distributed in nature and are closely associated with animals. Thirteen of the 15 isolates were from blood cultures, and most *S. typhi* isolates were imported, mainly from the Indian subcontinent. This supports the observation of relative rarity of typhoid fever among Kuwaiti nationals (personal observation). However, the agents of non-typhoidal salmonellosis infect Kuwaitis and expatriates alike. There is evidence suggesting that the sources of human *Salmonella* infections largely originate from food products (19). Like the experience in the developed world, the majority of salmonellosis occurring in Kuwait were linked with consumption of meat, including poultry and eggs (Unpublished data from the Annual Report of the Kuwait Public Health Department). Many residents of Kuwait enjoy eating out in public cafes and local restaurants where the children, in particular, may prefer fast foods, such as sandwiches made with chicken, egg and meat as well as salads. Apart from the well-

established faeco-oral route of transmission, common in children, this may be an additional explanation for the preponderance of infected children over adults in this report.

USA (20) and Ling *et al.* (3) from Hong Kong indicate that their isolates were significantly less resistant than ours. However, the 13% resistance rate to

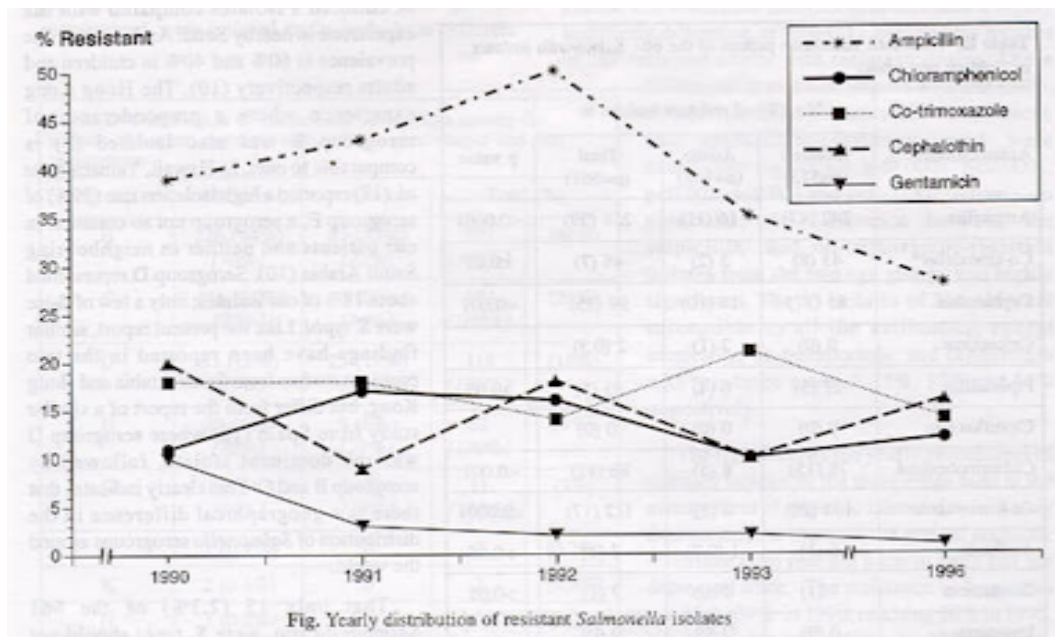


Fig. Yearly distribution of resistant *Salmonella* isolates

As could be expected, antibiotic resistance exists among the isolates. These resistant isolates were more common among the children than adults ( $p < 0.0001$ ), presumably reflecting the large number (more than three quarters) of *Salmonella* spp. that were encountered in children. This preponderance of resistant isolates in children may also be due to the fact that antibiotics, particularly ampicillin and co-trimoxazole, are frequently used for treating children for almost all respiratory tract infections (viral or bacterial) and diarrhoea in almost all the private clinics and hospitals. Resistance to ampicillin was at a very high (39%) level and so were the levels of resistance to co-trimoxazole (17%) and chloramphenicol (13%). These antimicrobials once were potent anti-*Salmonella* drugs and are still the drugs of choice in most developing countries. With respect to the high level of resistance to ampicillin in our study, the only comparable findings are those from Spain, where Reina *et al.* (11) and Munoz *et al.* (18) reported 34% and 32% resistance rates respectively. The experiences of Kambal (10) from Saudi Arabia, our next door neighbour, and Lee *et al.* from the

chloramphenicol compare well with the results in all these reports, except Lee's which reported a much lower level of resistance, and Ling's whose isolates showed 23% resistance rate. None of these studies recorded as high a resistance rate to co-trimoxazole as the 17% found in our study. In a previous report on 500 isolates studied for plasmid-mediated trimethoprim-resistance transfer in Kuwait in 1985, Chugh (21) found that about 15% were trimethoprim-resistant, indicating a much earlier resistance problem with *Salmonellae* in Kuwait. Much lower rates, 11%, were reported by Kambal (10), 2% by Reina *et al.* (11), 2% by Munoz *et al.* (18), 1% by Lee *et al.* (20), 6% by Ling *et al.* (3), and 9% by Araj *et al.* (22). These differences may reflect the use of antibiotics in different countries. It is pertinent that all the ampicillin-resistant isolates in our study also produced  $\beta$ -lactamases, which essentially agrees with previous studies (3,10,23). Over 16% of these isolates were also resistant to amoxicillin/clavulanic acid. This may be due to an overproduction of normal  $\beta$ -

lactamases by these strains as previously suggested by Ling *et al.* (3).

All our isolates, including *S. typhi*, were susceptible to ciprofloxacin and imipenem. Ciprofloxacin is a currently recommended drug for the treatment of *S. typhi* and invasive non-typhoidal *Salmonella* spp. and for prophylaxis in recurrent or relapsing cases of salmonellosis (23-25). Its use is particularly recommended in patients who come from the Indian subcontinent and the Middle East where strains resistant to ampicillin, chloramphenicol, and co-trimoxazole have been reported (26-29). Although ciprofloxacin resistance is not reported among our isolates, as it is in Kambal's study, an increasing trend in ciprofloxacin resistance has been reported in England and Wales. There, between 1991 and 1994, ciprofloxacin resistance in *Salmonella* spp. increased from 0.3% to 2.1% and in some species, *S. hadder*, resistance as high as 39% was reported (30). Indiscriminate use of this antibiotic, as is currently practised in most of our polyclinics and private hospitals, may precipitate this type of resistance problem. Susceptibility to imipenem was also 100%, while over 99% were susceptible to cefotaxime and amikacin. Similar degree of high susceptibility rates to these agents has been noted by other workers (3,9,10). Susceptibility to the two aminoglycosides is excellent, although their use in *Salmonella* infections is of limited value. While excellent activity was observed with the representative member of the third-generation cephalosporins, cefotaxime, over 15% of the isolates were resistant to cephalothin, almost similar to the findings in a report from Hawaii of 12% (17) but much higher than the figures in Lee's and Araj's reports from the USA (20) and Lebanon (22) respectively.

In conclusion, the majority of childhood and adult *Salmonella* isolates belonged to serogroup B. This serogroup is the most commonly isolated serogroup from poultry and other animals. It also accounts for the vast majority of our resistant strains. The resistance of *Salmonellae* to first-line antibiotics is high, i.e. ampicillin, chloramphenicol, co-trimoxazole, and cephalothin. Empirical use of these agents in invasive or enteric fever should be with caution. The use of ciprofloxacin in these situations, including children with infections caused by multiresistant invasive *Salmonella* spp. (31), appears to be justified.

#### REFERENCES

- Casalino M, Yusuf MV, Nicoletti M, *et al.* A two-year study of enteric infections associated with diarrhoeal diseases in children in urban Somalia. *Trans R Soc Trop Med Hyg* 1988;82:637-41.
- Echeverria P, Taylor DN, Suthienkul O. Recent advances in bacterial diarrhoea. *Southeast Asian J Trop Med Public Health* 1986;17:627-34.
- Ling JM, Zhou GM, Woo THS, French GL. Antimicrobial susceptibilities and  $\beta$ -lactamase production of Hong Kong isolates of gastroenteric *Salmonellae* and *Salmonella typhi*. *J Antimicrob Chemother* 1991;28:877-85.
- Mikhail IS, Fox E, Haberberger R, Ahmed MH, Abbatte EA. Epidemiology of bacterial pathogens associated with infectious diarrhoea in Djibouti. *J Clin Microbiol* 1990;28:956-61.
- Ogunbi O, Hunponu-Wusu OO, Coker AO, *et al.* Bacterial and viral agents associated with diarrhoeal diseases in Lagos, Nigeria. In: Emejuaiwe OS, Ogunbi O, Sanni SO, editors. Global impacts of applied bacteriology (Sixth International Conference). London: Academic Press, 1980:427-34.
- Ogunsanya TI, Rotimi VO, Adenuga A. A study of the aetiological agents of childhood diarrhoea in Lagos, Nigeria. *J Med Microbiol* 1994;40:10-4.
- Sethi SK, Khuffash FA, Al-Nakib W. Microbial etiology of acute gastroenteritis in hospitalized children in Kuwait. *Pediatr Infect Dis J* 1989;8:593-7.
- Kim KH, Suh IS, Kim JM, Kim CW, Cho YJ. Etiology of childhood diarrhea in Korea. *J Clin Microbiol* 1989;27:1192-6.
- Goossens H, Vanhoof R, Demol P, Grados O, Ghyselas G, Butzler JP. *In vitro* susceptibility of *Salmonellae* to antimicrobial agents. *J Antimicrob Chemother* 1984;13:559-65.
- Kambal AM. Antimicrobial susceptibility and serogroups of *Salmonella* isolates from Riyadh, Saudi Arabia. *Int J Antimicrob Agents* 1996;7:265-9.
- Reina J, Gomez J, Serra A, Borrel N. Analysis of the antibiotic resistance detected in 2043 strains of *Salmonella enterica* subsp. *enterica* isolates in stool cultures in Spanish patients with acute diarrhoea (1986-1991). *J Antimicrob Chemother* 1993;32:765-9.
- Griggs DJ, Hall MC, Jin YF, Piddock LJV. Quinolone resistance in veterinary isolates of *Salmonella*. *J Antimicrob Chemother* 1994;33:1173-89.
- Piddock LJV, Whale K, Wise R. Quinolone resistance in *Salmonella*: clinical experience. *Lancet* 1990;335:1459-60.
- WHO calls for action on spread of drug resistant diseases. Press release WHO/95, 5th December 1994.
- MMWR. Establishment of a national surveillance program for antimicrobial resistance in *Salmonella*. *JAMA (Med East)* 1996;275:22.
- Approved standard NCCLS Doc M7-A3; methods for dilution antimicrobial susceptibility tests for bacteria that grow aerobically. 3d ed. Villanova, PA: National Committee for Clinical Laboratory Standards, 1993:1720.
- Yamamoto LG, Ashton MJ. *Salmonella* infections in infants in Hawaii. *Pediatr Infect Dis J* 1988;7:48-52.



18. Munoz Patrica, Doleres Diaz M, Rodriguez-Creixems M, Cercenado E, Pelaez T, Bouza E. Antimicrobial resistance of *Salmonella* isolates in a Spanish hospital. *Antimicrob Agents Chemother* 1993;37:1200-2.
19. Parker-Baired AC. Food born salmonellosis. *Lancet* 1990;336:1231-5.
20. Lee LL, Puher ND, Maloney EK, Bean NH, Tauxe RV. Increase in antimicrobial resistant *Salmonella* infection in the United States, 1989-1990. *J Infect Dis* 1994;170:128-34.
21. Chugh TD. Transferable resistance to trimethoprim in enteric pathogens isolated in Kuwait. *J Hyg* 1985;95:391-5.
22. Araj GF, Uwaydah MM, Alami SY. Antimicrobial susceptibility patterns of bacterial isolates at the American University Medical Center in Lebanon. *Diagn Microbiol Infect Dis* 1994;20:151-8.
23. Alos JI, Gomez-Graces JL, Gogollos R, Amor E, Perez-Rivilla A. Susceptibilities of ampicillin-resistant strains of *Salmonella* other than *S. typhi* to 10 antimicrobial agents. *Antimicrob Agents Chemother* 1992;36:1794-6.
24. Stanley PI, Flegg PJ, Mandal B, Geddes AM. Open study of ciprofloxacin in enteric fever. *J Antimicrob Chemother* 1989;23:789-91.
25. Gorbach SL, Mensa Jose, Gatell JM. Pocket book of antimicrobial therapy and prevention. Baltimore: Williams and Wilkins, 1997:198-9
26. Bhutta ZA, Naqui SH, Razzaq RA, Farooqui BJ. Multidrug-resistant typhoid in children: presentation and clinical features. *Rev Infect Dis* 1991;13:832-6.
27. Mandal BK. Modern treatment of typhoid fever. *J Infect* 1991;22:1-4.
28. Panigrahi D, Roy P, Sehgal R. Ciprofloxacin for typhoid fever. *Lancet* 1991;338:1601.
29. Rowe B, Ward LB, Threfall EJ. Multidrug resistant *Salmonella typhi*: a world-wide epidemic. *Clin Infect Dis* 1997;24 (Suppl1):S106-9.
30. Frost JA, Kelleher A, Rowe B. Increasing ciprofloxacin resistance in salmonellas in England and Wales. *J Antimicrob Chemother* 1996;37:85-91.
31. Green S, Tillotson G. Use of ciprofloxacin in developing countries. *Pediatr Infect Dis J* 1997;16:150-9.

# Difficulties in Conducting Participatory Action Research to Prevent Diarrhoea in a Slum Area of Bangkok

SUNGKOM JONGPIPUTVANICH<sup>1</sup>, SURIYA VEERAVONGS<sup>2</sup>, AND WATHANA WONSEKIARTTIRAT<sup>2</sup>

<sup>1</sup>*Department of Pediatrics, Faculty of Medicine and* <sup>2</sup>*University Social Research Institute, Chulalongkorn University, Bangkok 10330, Thailand*

## ABSTRACT

**Childhood diarrhoea is a major cause of childhood morbidity and mortality in Thailand. During April 1988-April 1990, a study was conducted to evaluate participatory action research as a method of intervening on unhygienic practices in two communities in the Klong Toey slum of Bangkok (intervention group) and compared these practices in two other communities of the same slum where there was no intervention (control group). The following variables were compared in two groups: hygiene behaviour and factors associated with participation of community leaders and mothers with children aged less than five years. Two hundred and twenty-one mothers of the original 606 (36%) were still available at the end of the study. It was found that the mothers in the intervention groups were more likely to wash their hands before feeding and use cupboards and covered containers for keeping food. Several factors negatively affected community participation: matters concerning the slum culture and organization, community leadership, family problems, occupational problems, and physical environment of the community. The conclusions of the study are limited because of the considerable proportion of the subjects that was lost to follow-up. The study points at some of the methodological issues when conducting research in challenging and difficult to reach communities that have important health problems.**

*Key words:* Diarrhoea, Infantile; Diarrhoea; Hygiene; Community participation; Operations research; Knowledge, attitudes, practice

## INTRODUCTION

Diarrhoea still remains a major preventable health problem in developing countries (1). In Thailand, it is the second most common cause of death in children aged less than one year and also in older age groups (2). Rotavirus and pathogenic enteric bacteria contaminating water and food are responsible for most cases of diarrhoea (3). Risk factors for diarrhoea include malnutrition, poor gastrointestinal absorption, poor personal hygiene, environmental sanitation problems, unhygienic food preparation, improper sewage disposal and improper use

of latrines, early discontinuation of breastfeeding, and unhygienic bottle-feeding (4,5). The parents' beliefs about diarrhoea in their children and their attitudes and practices influence these risk factors (6). Intervention programmes that focus on changing unhygienic behaviours may reduce diarrhoeal disease. Yet, in developing countries, most hygiene interventions to

---

Correspondence and reprint requests should be addressed to: Dr. Sungkom Jongpipitvanich  
Department of Pediatrics, Faculty of Medicine  
Chulalongkorn University, Bangkok 10330, Thailand  
E-mail: fmedsjp@md2.md.chula.ac.th

reduce diarrhoea have been ineffective, not feasible, inappropriate or too costly, because they have been developed without examining the cultural context and the needs of the people (7,8). Therefore, the need for community participation in the intervention programme and the understanding of local needs, attitudes, and skills are vital to the success of any such intervention (9). Participatory action research (PAR) is one type of intervention that involves active participation of members of the community. In PAR, community residents act as research assistants and participate actively in all phases of the programme: problem identification, information gathering, interpretation of findings, implementation, monitoring, and evaluation. Thus, PAR is a method for materializing a "bottom up" approach of solving problems. It has been effective in promoting breastfeeding, use of oral rehydration therapy (ORT), and immunization in slum areas in Ecuador (10). In rural Bangladesh, PAR has been used for modifying hygiene behaviour and for reducing diarrhoea and malnutrition (11). The purpose of the present study was to evaluate the effectiveness of PAR in improving hygienic practices and increasing the appropriate use of ORT among mothers who had children aged less than five years in the slum areas of Bangkok.

## SUBJECTS AND METHODS

### Study site and population

Four communities (Romklao, Huakhong, Lock 123, and Lock 456) in the Klong Toey slum of Bangkok were chosen for the study. We choose these communities because they were a few miles from the Chulalongkorn University Hospital. The Klong Toey slum, the oldest and biggest low socioeconomic community in Bangkok, consists of 18 communities, encompasses approximately 800 rai (320 acres) of land, and accommodates about 7,000 households with the population estimated at 32,000 individuals. People in this area have living conditions similar to those in other slum areas around Bangkok: they suffer from poverty, overcrowding, bad housing with cheap and non-durable materials, inadequate piped water supply, poor hygienic conditions, constant flooding and typical narrow wooden walkways zigzagging throughout the area.

All children aged less than five years in the 4 communities were identified. Each child's mother was asked to enroll in the study. Mothers who were planning to move out of the area within the 2-year study period

were excluded from enrollment. The four selected communities were randomly allocated to two groups.

#### 1. *Intervention Group* (Lock 456 and Romklao):

The intervention group was provided with community education, participation and health education programmes using the participatory action research approach. There initially were 274 mothers in this group.

#### 2. *Control Group* (Lock 123 and Huakhong):

The control group was not provided with any intervention programme other than the existing diarrhoea surveillance system. However, standard advice on seeking appropriate care was provided to mothers who had children with chronic diarrhoea (duration more than two weeks) or severe dehydration in both control and intervention communities. At the start of the programme, 332 mothers were selected in the control group.

### Sample size calculation

We did a sample calculation based on two assumptions. First, we assumed that the prevalence of unhygienic practices could be as high as 90% and that it could be brought down to at least 80%. Second, the figures were changed to 30% and 15% respectively. The sample sizes for an exposed/unexposed proportion of 1/1 then are 2\*220 for the first assumption and 2\*135 for the second one. Although we did not obtain the 1/1 proportion, but rather 0.8, it would appear that at the intake of the mothers, the numbers were more than sufficient.

### Study design and interventions

The intervention programme was carried out during April 1988-April 1990 through contacts and cooperation with community committees to increase the participation of the slum inhabitants. The committees consisted of community leaders, members of a community board elected by the people of each slum every four years. A Community Education and Participation Programme (CEP) was carried out after the research team had built up rapport with the people in the community. Two main activities were pursued.

1. *Community preparation.* This activity consisted of group meetings with mothers in the intervention group once a week during an initial 2-month period.

2. *PAR process.* Before starting the intervention programme, the research team conducted a meeting to

inform the community committee about the research programme.

During the intervention, the researchers conducted group discussions with the mothers and community leaders in the intervention group once a month at the study site to ensure that the participants understood the research programme. Group discussions were also used for health education programmes, specifically relating to knowledge about causes and effects of diarrhoea, and methods to prevent and treat diarrhoea. The education programmes included:

1. *Problem identification and diagnosis.* Mothers were taught to recognize behaviours that increased the risk of diarrhoeal illness in children.

2. *Planning activities.* Mothers were taught to modify “undesirable” behaviour and to use behaviour likely to reduce diarrhoea, such as breastfeeding, hand-washing, hygienic bottle-feeding, hygienic disposal of garbage and faeces, and appropriate use of oral rehydration therapy.

3. *Management.* Mothers and community leaders were also trained in how to manage and administer the programme.

4. *Monitoring and evaluation.* The health education programme was set up by the mothers’ groups and the community committee. The results of the education programme were reported by field workers, especially the problems which had to be solved to improve the programme.

The research team provided participants with skills to motivate other mothers and community leaders to assist in the implementation of the programme, to transfer knowledge about prevention of diarrhea, and to create awareness of child diarrhoea as an important health problem. In the group discussions, the research team members played the role of stimulators to create awareness of child diarrhoea as a health problem. The materials used in group discussion included flip charts, posters, and slides provided by several government agencies and non-governmental organisations.

#### Data collection and analysis

The effectiveness of the intervention programmes was assessed by comparing the following hygienic practices in both intervention and control communities: [1] hand-washing before preparing and eating food, [2] boiling

feeding bottle, [3] proper storage of food (using cupboards and covered containers), [4] proper disposal of garbage and [5] faeces (in dustbins and latrines respectively); and [6] appropriate use of ORT (when to initiate, amount and correct preparation). Four trained field workers and two trained social scientists collected information on behaviour at the start and end of the study period. Information was collected in the following ways:

1. Structured interviews were conducted by the field workers to obtain information about socioeconomic status (family incomes, years of education, etc.) and hygienic behaviour in the study households.

2. Direct observation was used by two trained social scientists for obtaining information about community participation of mothers in the intervention communities only.

3. Unstructured or in-depth interviews were conducted to obtain detailed answers to questions about hygienic behaviour of mothers who actively participated in the intervention group.

4. Group discussions between mothers and the research team were conducted every month to obtain information about the intervention programme, events and problems occurring during implementation and the influence of the PAR approach on behaviour.

Information was recorded on the pre-designed forms, and the responses were coded. Data were entered into a computer and analyzed with the BMDP statistical package. Hygienic behaviour and demographic data in the control and intervention groups were compared using chi-squared or two-tailed Fisher’s exact probability tests or *t*-test, as appropriate.

## RESULTS

The demographic characteristics of the participating mothers in the control and intervention communities are shown in Table I. Most mothers were stay-at-home housewives (63%), aged between 20 and 34 years (77%) and had only completed primary education (72%). Most mothers were living with their husbands, who were aged between 20 and 34 years, had completed primary education, and were working as daily wage workers. Most households (86%) had monthly incomes of less than 5,000 baht (US\$125). The household size was small with a median of two children, 91% of the study

households having one to three children. There was no difference in socioeconomic status of mothers in the intervention and the control group at entry in the study. Baseline hygiene behaviour is shown in Table II. As had to be expected, the overall picture was bleak. In 4 of the 6 items studied, 8 of the 10 mothers did very poorly. They did not wash their hands before feeding, and did not boil feeding bottles. Neither did they dispose hygienically of faeces or knew how to use ORT.

to follow-up of 385 mothers (64%) was due to moving out of their relatives' houses, moving out of rented accommodation, or moving out of the study area. Demographic characteristics of the mothers who were and who were not followed-up were similar (Table III).

### Community participation

Ninety-nine (36%) mothers in the intervention group were active participants in group discussions and training activities. They joined in at least 70% of activities and cooperated and actively participated in the intervention programme, e.g. motivated other mothers to join the programme, discussed diarrhoeal disease in children in their communities and ways to improve hygienic practices. The remaining 175 (64%) mothers in the intervention group did not participate actively. They only attended the general meeting that introduced the project to the community. From the in-depth interview, group discussion and directed observation, we found that the following factors affected community participation.

**Table I.** Demographic characteristics of participating mothers in control and intervention communities

Characteristics	Intervention group (n = 274) Mean (SD)	Control group (n = 332) Mean (SD)	p value
Age of mothers (years)	26.6 (6.2)	25.5 (6.0)	>0.05
Education of mothers (years)	7.6 (1.2)	7.4 (1.0)	>0.05
Monthly household income (median and range)			
(Bath (US\$))	2,900 (1,000-10,000) 72.5 (25-250)	3,000 (1,000-10,000) 75 (25-250)	>0.05
No. of children (Median and range)	2 (1-4)	2 (1-4)	0.05

**Table II.** Baseline survey of hygiene behaviour of mothers in intervention and control communities

Behaviour	Intervention group (n=274) (100%)	Control group (n=332) (100%)	p value
Washing hands before feeding	62 (23%)	70 (21%)	>0.05
Boiling feeding bottles	37 (14%)	32 (10%)	>0.05
Keeping food properly	195 (71%)	217 (65%)	>0.05
Proper garbage disposal	159 (58%)	178 (54%)	>0.05
Proper disposal of faeces	61 (22%)	77 (23%)	>0.05
Appropriate use of ORT	41 (15%)	59 (18%)	>0.05

Only 221 (36%) of the original 606 mothers were available to follow-up at the end of the study period. Loss

problems associated with their housing and physical environment.

1. *Heterogeneity of the participants:* People living in the slum community included migrants from remote rural areas, Bangkokians who had moved to a cheaper rent areas of the city, or came to live with a spouse, and those who were born in the community. Great effort was needed to bring this heterogeneous group from different subcultures together and to form an action group with a common leadership. Many community leaders and people in the study areas did not consider diseases a major problem and tended to restrict their attention to solve

2. *Social and economic problems and lack of interest in health matters:* In-depth interviews identified family problems, such as quarrels and violent behaviour, lack of money for household expenditure due to gambling, drunkenness, drug addiction, separation and divorce as reasons for not becoming involved in the community health intervention programme. Inconsistent participation in activities resulted in lack of continuity in group gatherings and discussion. Interestingly, about 30% of the mothers without family difficulties did not participate in the intervention programme after they knew that they would not receive money or gifts, which they usually expected to get from every programmes carried out in the slum area.

**Table III.** Initial demographic characteristics of mothers who were traced and those who were lost to follow-up

Characteristics	Not traced (n=385) Mean (SD)	Traced (n=221) Mean (SD)	p value
Mother's age (years)	26.2 (6.3)	25.6 (5.7)	>0.05
Mother's education (years)	7.5 (1.2)	7.4 (0.9)	>0.05
Monthly household income (median and range)			
Bath per month	3,000 (1,000-10,000)	3,000 (1,000-10,000)	>0.05
US\$	75 (25-250)	75 (25-250)	
Number of children (median and range)	2 (1-4)	2 (1-4)	>0.05

**Table IV.** Hygienic behaviour in intervention and control communities at the end of the study period

Behaviours	Intervention group (n=114) (100%)	Control group (n=107) (100%)	p value
Washing hands before feeding			
Improved	33 (29%)	18 (17%)	0.03
No change	81 (71%)	89 (83%)	
Boiling feeding bottles			
Improved	15 (68%)	8 (73%)	1.00
No change	7 (32%)	3 (27%)	
Keeping food properly			
Improved	19 (17%)	7 (7%)	0.02
No change	95 (83%)	100 (93%)	
Proper garbage disposal			
Improved	15 (13%)	26 (24%)	0.03
No change	99 (87%)	81 (76%)	
Proper disposal of faeces			
Improved	31 (38%)	34 (48%)	0.03
No change	50 (62%)	37 (52%)	
Appropriate use of ORT			
Improved	39 (48%)	37 (52%)	0.06
No change	42 (52%)	34 (48%)	

### Impact on changing maternal behaviour

Structured interviews conducted by the field workers after the intervention period revealed that the mothers in the intervention group were more likely than the mothers in the control group to wash their hands before feeding and to store foods properly (using cupboards and covered containers). Quite paradoxically, the control group scored better than the intervention group in disposing garbage and faeces properly. There were no statistically significant differences in boiling milk bottles and appropriate use of ORT, but the numbers of respondents were small to very small (Table IV).

Reasons given by those who did not improve hygienic practices included lack of time to wash their hands before feeding, no necessity to cover food, because there was no food left after eating; belief that soaking bottles in warm water was adequate, and lack of time to boil

the bottles; lack of own dustbins close to the house, and lack of easy access to community dustbins (too far away from the house); beliefs that disposal of faeces under the house was adequate; and beliefs that children disliked the taste of ORS, so that mothers preferred using medication, such as lomotil, kaolin, and pectin, to treat their children with diarrhoea.

### DISCUSSION

Overall, the results of our participatory action research were disappointing. Since this study was designed to evaluate the effectiveness of a community-based PAR to improve hygiene behaviour associated with prevention of diarrhoea in children aged less than five years, communities and not mothers were randomized to be the intervention and control groups. The only hygienic behaviours that improved in the intervention group were washing hands before feeding and keeping food properly, whereas paradoxically, mothers in the control group were more likely to dispose garbage and faeces properly. Only 22 mothers of the intervention group and 11 of the control group answered to the question about boiling feeding bottles (Table IV). These figures are too small to yield reliable results, and anyhow it would have been better to promote prolonged breastfeeding rather than boiling feeding bottles.

There are several potential explanations for these findings. First, 64% of the mothers were unavailable for follow-up. It is possible that the mothers who remained in the slums were different from mothers who left the slums, particularly in relation to improving hygiene behaviour. This large drop-out rate is a particular problem of communities that include a large proportion of transients, such as a slum area. To avoid this difficulty, we could have evaluated behaviour at several points during the study, or could have attempted to trace a random subset of the study mothers who left the area. Both of these have methodological limitations. The process of observation or evaluation of behaviour itself during the study might have become an intervention causing subjects to change their behaviour. Changes in behaviour could result from the intervention programme but also from being observed or evaluated. Evaluation of the mothers who left the area may not permit evaluation of the intervention, because changes in behaviour may be associated with a new environment. Although results of studies with large losses to follow-up may be biased by factors associated with moving away from the study

area, this study is encouraging, because in those who remained, there was improvement in the way that they washed hands before feeding and stored food. Second, like other community members, many mothers believed that their main problem was housing, particularly avoiding eviction from the public land controlled by the government. Low income and limited employment opportunities were also seen as problems. Only 36% of the mothers in the intervention group actively participated in the intervention programme. This might not engage a sufficient proportion of the mothers to change hygienic behaviours of the majority of the mothers. Practices that did not improve tended to be those that were limited by physical environment. Crowded houses and dirty puddles under the houses provided no incentive to keep the community clean, especially by ensuring adequate garbage disposal. Third, and most importantly, the limited success of our intervention probably was because it was not appropriate for this study population. Poor slum dwellers are more interested in their precarious living circumstances than in their children's health. The targets of the intervention, while theoretically sound, might not have been realistic. Washing hands, storing leftover food properly, boiling feeding bottles, disposing of faeces and garbage properly, all might be beyond the possibilities of people having to live in utmost squalor and without strong social bonds. Extreme poverty perhaps makes the mothers unreceptive to the message we tried to convey. Since slum dwellers came from all over Thailand and were from different cultures, a different or greater effort may be needed to bring them together into action groups. In rural societies, where people often meet and discuss their experiences, community organization to improve health behaviours may not be so difficult to achieve (12).

We have highlighted some problems of conducting participatory action research in a transient population, so that future research may address the methodological shortcomings that we found. It is clearly important to assess the culture, organization, family problems, occupational problems, the physical environment, and population migration before implementing a study. We suggest that future studies also address change in the incidence of diarrhoea as an additional outcome.

### ACKNOWLEDGEMENTS

The authors wish to thank Dr. Richard Cash and Dr. Patricia L. Hibberd for their editorial comments on the manuscript and

express our deep gratitude to the Applied Diarrheal Disease Research Project (ADDR) of the Harvard Institute for International Development (HIID) for providing research funding.

#### REFERENCES

1. Bern C, Martinez J, de Zoysa I, Glass RI. The magnitude of the global problem of diarrhoeal disease: a ten-year update. *Bull WHO* 1992;70:705-14.
2. Annual epidemiological surveillance report. Bangkok: Division of Epidemiology, Ministry of Public Health, 1995.
3. Black RE, Brown KH, Becker S, Alim ARMA, Merson MH. Contamination of weaning foods and transmission of enterotoxigenic *Escherichia coli* diarrhoea in children in rural Bangladesh. *Trans R Soc Trop Med Hyg* 1982;76:259-64.
4. Black RE, Lanata CF. Epidemiology of diarrheal diseases in developing countries. In: Blaser MJ, Smith PD, Ravdin JI, Greenberg HB, Guerrant RL, editors. *Infections of the gastrointestinal tract*. New York: Raven Press, 1995:13-36.
5. Brown KH, Black RE, de Romana GL, de Kanashior HC. Infant-feeding practices and their relationship with diarrheal and other diseases in Huascar (Lima), Peru. *Pediatrics* 1989;83:31-40.
6. Pelto GH. The role of behavioral research in the prevention and management of invasive diarrheas. *Rev Infect Dis* 1991;13(Suppl 4):S255-8.
7. Feachem RG, Hogan RC, Merson MH. Diarrhoeal disease control: reviews of potential intervention. *Bull WHO* 1983;61:637-40.
8. World Health Organization. Child care practices related to diarrhoeal diseases. Geneva: Diarrhoeal Disease Control Programme, World Health Organization, 1979. (WHO/CDD/SER 79.4)
9. Hill JM, Woods ME, Dorsey SD. A human development intervention in the Philippines: effect on child morbidity. *Soc Sci Med* 1988;27(11):1183-8.
10. UNICEF Sub-office. Primary health care in slum areas of Guayaquil, Ecuador. *Assignment Children* 1982;63/64.
11. Ahmed NU, Zeitlin MF, Beiser AS, et al. A longitudinal study of the impact of behavioral change intervention on cleanliness, diarrhoeal morbidity and growth of children in rural Bangladesh. *Soc Sci Med* 1993;37:159-71.
12. Tennakoon S. Community participation in health activities. *World Health For* 1987;8:383-4.



# Diarrhoea in Children of Nigerian Market Women: Prevalence, Knowledge of Causes, and Management

FOLASHADE O OMOKHODION, ADEFUNKE OYEMADE, MYNEPALLI KC SRIDHAR,  
ISAAC O OLASEHA, AND JOSHUA F OLAWUYI

*Department of Preventive and Social Medicine, University College Hospital, Ibadan, Nigeria*

## ABSTRACT

A cross-sectional survey was carried out among mothers of children aged less than five years in two markets in Ibadan, one with poor environmental sanitation and the other clean and well maintained. The study took place between September 1996 and March 1997. The questionnaire used for this survey sought information about the occurrence of diarrhoea among children aged less than five years, their mothers' knowledge about the management of diarrhoea and their practices, including care-seeking practices, and the use of oral rehydration solutions. Two hundred and sixty-six mothers were interviewed in the first market (Bodija) and 260 in the other (Gbogi). Thirty-seven percent of the children in the cleaner market (Gbogi) were said to have had diarrhoea within the last 3 months compared to 33% of the children in the unhygienic Bodija market ( $p>0.05$ ). These results suggest that environmental sanitation may not be a major determinant of diarrhoea among children of the two groups of market women. When their children had diarrhoea, 44% (Bodija) and 40% (Gbogi) of the mothers attended health centres, 33% (Bodija) and 32% (Gbogi) gave ORT at home, and 12% (Bodija) and 19% (Gbogi) purchased drugs at a chemist. The study further showed that, while only one-third of all respondents resorted to home-treatment of diarrhoea with ORS, more than 80% of them knew the components and composition of ORS solution. There is a need to continue to encourage mothers to use ORS and, thus, bridge the knowledge-practice gap in mothers' management of diarrhoea at home.

*Key words:* Diarrhoea, Infantile; Environment; Sanitation; Oral rehydration solutions; Oral rehydration therapy; Knowledge, attitudes, practice; Cross-sectional studies

## INTRODUCTION

An increasing number of women engage in work outside their homes to provide financial support for themselves and their families. In affluent societies, the burden of combining economic activities with the traditional role as homemakers is lessened by the availability of day-care centres, domestic appliances and other social amenities. In the poorer segments of less-developed countries, such facilities are not available or affordable. Consequently, many women, especially those who are self-employed,

are forced to take their young children with them to their work, thereby exposing them to the hazards of their work environment.

In Nigeria, a large proportion of women in the lower socioeconomic strata are petty traders. Many sell their wares in markets that are characterised by poor

Correspondance and reprint requests should be addressed to: Dr. Folashade O Omokhodion  
Department of Preventive and Social Medicine  
University College Hospital, Ibadan, NIGERIA  
E-mail: dhf.omokhodion@skannet.com

environmental conditions. Thus, the children who often accompany their mothers to the market are constantly exposed to health hazards, especially contaminated food and water.

Diarrhoea is an important cause of morbidity and mortality in this environment (1-3) conceivably because of the unsanitary conditions, to which young children are known to be more vulnerable than adults. The present study attempts to determine the occurrence of diarrhoea among the children aged less than five years in two markets, each with a different state of environmental sanitation. As the recognition and management of diarrhoea by mothers is crucial to the outcome of the disease in children (4), the study also seeks to collect information on the market women's knowledge, attitude and practice with regard to the management of diarrhoea in their young children.

#### SUBJECTS AND METHODS

This cross-sectional study was carried out between September 1996 and March 1997 in Bodija and Gbagi markets, both situated in different areas of Ibadan. Bodija market is predominantly a food market with 3,596 stalls, while Gbagi is mainly a textile market with 2,853 stalls. Gbagi market is clean and well laid out with tarred roads, good drainage, and an effective refuse disposal system. Bodija market, on the other hand, is overcrowded with more than half of the traders displaying their food items along the roadside away from the designated stalls. The roads are untarred and littered with refuse: environmental sanitation is poor in Bodija market.

Permission to carry out the study was sought from the chairmen of the two local government areas. In addition, the leaders of the Market Women Association in each market were contacted to discuss the objectives of the study and to obtain their consent. Informed consent was also obtained from the mothers who participated in the study.

Each market is divided into blocks of stalls which are numbered in serial order. Only those mothers whose children aged less than five years had been staying with them in the market for at least 6 months were included in the survey. A sample-size estimation gave a minimum sample size of 260 for each group. Stalls were selected using a systematic random-sampling technique in which every 7th stall was chosen. Where no child aged less than five years was found in a particular stall, the next stall

was selected. In all, 266 mothers in Bodija and 260 in Gbagi markets were included in the survey. They were interviewed by trained interviewers using a structured questionnaire. This questionnaire was pre-tested on 20 mothers in another market before the main study. The questionnaire sought information on the social and demographic characteristics of respondents, occurrence of diarrhoea among their children aged less than five years, their perception of diarrhoea, knowledge and practice on the management of diarrhoea, including care-seeking practices, feeding practices, and the use of home oral rehydration solution (ORS). A child was considered to have had diarrhoea if he/she had passed 3 watery stools within 24 hours. Questionnaires were coded, and statistical analysis was done using EPI Info version 6.02 software to calculate frequencies. We computed chi-square for trend or contingency chi-square to check associations between categorical variables. Non-responders were considered separately.

#### RESULTS

##### *Social and demographic characteristics*

The age distribution of 526 mothers (266 in Bodija and 260 in Gbagi) who were interviewed is presented in Table I. Eighty-nine (33%) in Bodija and 94 (36%) in Gbagi were in the 26-30-year age group, the mode of the age distribution.

**Table I.** Age distribution of study population

Age (in years)	Bodija	Gbagi
<21	13 (5%)	5 (2%)
21-25	58 (22%)	72 (28%)
26-30	89 (33%)	94 (36%)
31-35	72 (27%)	59 (23%)
36-40	28 (11%)	25 (10%)
41-45	4 (2%)	3 (1%)
46-50	2 (1%)	0 (0%)
Over 50	0 (0%)	2 (1%)
Total	266 (100%)	260 (100%)

chi-square for trend: 0.42,  
degree of freedom: 1; p=0.52

Eighty-one (30%) of the Bodija mothers and 42 (16%) of their counterparts in Gbagi had completed primary education. Sixty-two (23%) in Bodija and 100 (39%) in Gbagi had completed secondary education. Post-secondary education was recorded for 5 (2%) mothers in Bodija and 20 (8%) in Gbagi (Table II). There was no significant difference in the age distribution of the mothers, but the educational status of the Gbagi mothers was significantly higher than that of the Bodija ones ( $p < 0.001$ ).

Educational status	Bodija	Gbagi
1. No education	57 (21%)	27 (10%)
2. Some primary	32 (12%)	23 (9%)
3. Complete primary	81 (30%)	42 (16%)
4. Some secondary	29 (11%)	47 (18%)
5. Completed secondary	62 (23%)	100 (39%)
6. Higher education	5 (2%)	20 (8%)
Total	266 (100%)	259 (100%)

chi-square for trend: 36.58,  
degree of freedom: 1;  $p < 0.0001$

### **Occurrence of diarrhoea**

In Bodija, 232 children aged less than five years were seen during the study -- 123 (53%) males and 109 (47%) females. Of these children, 76 (33%) were infants, while 156 (67%) were aged 1-5 years. In Gbagi, 219 children aged less than five years were seen -- 108 (49%) males and 111 (51%) females. There were 95 (43%) infants, and 124 (57%) were aged between 1 and 5 years.

Two hundred and fifty mothers in Bodija and 234 in Gbagi responded to the inquiry about the occurrence of diarrhoea in their children during the past 3 months. The responses are shown in Table III. One hundred and sixty-eight (67%) of the 250 Bodija mothers and 147 (63%) of the 234 in Gbagi reported no episodes of diarrhoea in their children. Nineteen (8%) of the Bodija mothers and 35 (15%) of the Gbagi respondents reported diarrhoea twice, while 18 (7%) of the former group and 7 (3%) of the latter reported diarrhoea in their children as occurring thrice during the period. Of the 250 Bodija mothers who responded, 82 children (33%) had had diarrhoea in the 3 months preceding the survey. In Gbagi, with 234 respondents, 87 (37%) children had presented diarrhoea. This difference is not statistically significant ( $p = 0.31$ ).

### **Knowledge of the causes of diarrhoea**

The respondents' perception of the causes of diarrhoea is shown in Table IV. One hundred and forty-nine (60%) of the respondents in Bodija and 127 (49%) of those in Gbagi indicated that dirty food was a cause of diarrhoea. Sixty-three (25%) and 37 (17%) in Bodija and Gbagi respectively mentioned dirty water as a cause, while teething was thought to be a cause by 27 (11%) of the Bodija women and 40 (19%) of those in Gbagi. Fever and dirty hands were also mentioned as possible causes, but only by a minority of the mothers. The differences between the two groups are not significant ( $p = 0.12$ ).

### **Management of Diarrhoea**

#### **Knowledge of the components of oral rehydration solution**

The components of home-made ORS as reported by the mothers are shown in Table V. Two hundred and twenty (87%) of the Bodija respondents and 195 (89%) of the Gbagi ones correctly mentioned salt, sugar and water as the components; other combinations are as shown in the Table. It is noteworthy that only 16 (6%) and 12 (5%) of the Bodija and Gbagi respondents respectively had no knowledge of the components.

#### **Composition of the salt-sugar solution**

The composition of the home-made salt-sugar solution (SSS) as reported by the mothers is shown in Table VI. This was compared with the Federal Ministry of Health's recommended composition of 10 level teaspoonfuls (or 5 cubes) of sugar and 1 level teaspoonful of salt in 1 litre of water. Two hundred and twelve (83%) of the Bodija respondents and 194 (88%) of the Gbagi ones knew the correct amount of salt and sugar in a litre of water. Thirty-four (13%) of the Bodija and 20 (9%) of the Gbagi respondents had no proper knowledge of the composition of SSS.

#### **Care-seeking practices**

Mothers' reported care-seeking practices when their children fall ill with diarrhoea are shown in Table VII. Ninety-seven (44%) of the responding Bodija mothers and 74 (40%) of those in Gbagi attended health centres, clinics, or hospitals. Seventy-three (33%) of the mothers in Bodija and 59 (32%) of the respondents in Gbagi reported that they gave oral rehydration with SSS at home. Twenty-seven (12%) of the mothers in Bodija and 35 (19%) of those in Gbagi went to the chemist to buy

drugs, while a relatively small number of the respondents resorted to self-medication with traditional herbs, consulted with the traditional herbalists or used drugs prescribed for previous episodes of diarrhoea.

frequency of diarrhoea (Table III). On the other hand, the Gbagi mothers did far more often not answer to questions about the causes of diarrhoea than the Bodija mothers (chi-square: 16.39;  $p < 0.0001$ ), the components of SSS (chi-square: 15.50;  $p < 0.0001$ ), the preparation of SSS (chi-square: 18.04;  $p < 0.0001$ ) and care-seeking practices (chi-square 10.01;  $p < 0.002$ ).

**Table III.** Occurrence of diarrhoea in the last 3 months

Response	Bodija			Gbagi		
	No.*	% Subtotal	% Total	No.*	% Subtotal	% Total
None	168	67%	63%	147	63%	57%
Once	41	16%	15%	39	17%	15%
Twice	19	8%	7%	35	15%	13%
Thrice	18	7%	7%	7	3%	3%
More than 3 times	4	2%	2%	6	3%	2%
Subtotal	250	100%	94%	234	100%	90%
No response	16	-	6%	26	-	10%
	266	-	100%	260	-	100%

\*contingency chi-square (respondents): 10.96, degrees of freedom: 4;  $p=0.028$

## DISCUSSION

The need for market women to attend to customers during the interview caused frequent interruptions. As a result, the interest to continue with the interview was either lessened or lost, and responses to some questions were not obtained. The better-educated Gbagi mothers were significantly less willing to answer to 4 of our 5 questions related to diarrhoea and its management. It is possible that they felt too sophisticated and were less inclined to provide answers to questions on basic hygiene practices.

In spite of the differences in environmental sanitation of the two markets, the occurrence of diarrhoea among the children aged less than years in both markets was similar. It has been shown (3) that the use of dirty feeding bottles and kitchen utensils, poor disposal of faeces and household refuse and storage of drinking water are significantly related to a high incidence of diarrhoea. In this study, the majority of the respondents indicated that their children's breakfast and dinner were prepared at home. It appears

**Table IV.** Causes of diarrhoea

Causes of diarrhoea	Bodija			Gbagi		
	No.*	% Subtotal	% Total	No.*	% Subtotal	% Total
Dirty food	149	60%	56%	127	60%	49%
Dirty water	63	25%	24%	37	17%	14%
Teething	27	11%	10%	40	19%	15%
Dirty hands	2	1%	1%	3	1%	1%
Fever	3	1%	1%	2	1%	1%
Other	4	2%	2%	3	1%	1%
Subtotal	248	100%	93%	212	100%	82%
No response	18	-	7%	48	-	18%
Total	266	-	100%	260	-	100%

\*contingency chi-square (respondents): 8.82; degrees of freedom: 5;  $p=0.12$

### Non-responding mothers

Non-response to questions varied from 4% to 28% as shown in the Tables. There was no statistically significant difference between the two groups when asked about the

that, in our study, the immediate causes of diarrhoea may not lie within the market environment *per se*, but may be related to hygiene practices with regard to food handling at home. The fact that only 1% of the mothers in the two markets mentioned dirty hands as a cause of

diarrhoea underscores their ignorance about the role of food handling in the aetiology of diarrhoea.

The study further reveals that knowledge about dirty food and dirty water as causative factors in the occurrence of diarrhoea increased with educational status. Occurrence of diarrhoea, however, was not associated with educational status. This contrasts with findings in other studies that reported a 5-fold increase in the incidence of diarrhoea among infants of illiterate compared to the educated mothers (5). Our study involved a majority of children aged between 1 and 5 years, who are less dependent on their mothers than infants. Also breastfeeding of infants rather than bottle-feeding has been gaining ground in recent years. It is possible that our subjects were more oriented to breastfeeding practices than those in previous studies. These two factors may make educational status less relevant.

**Table V.** Components of oral rehydration solution

Response	Bodija			Gbagi		
	No.*	% Subtotal	% Total	No.*	% Subtotal	% Total
Salt, sugar and water	220	87%	83%	195	89%	75%
Sugar, and water	10	4%	4%	7	3%	3%
Salt and water	6	2%	2%	5	2%	2%
Don't know	16	6%	6%	12	5%	5%
	252	100%	95%	219	100%	84%
No response	14	-	5%	41	-	16%
Total	266	-	100%	260	-	100%

\*contingency chi-square (respondents): 0.39; degrees of freedom: 3; p=0.94

**Table VI.** Composition of salt-sugar solution

Response	Bodija			Gbagi		
	No.*	% Subtotal	% Total	No.*	% Subtotal	% Total
5 cubes of sugar and 1 teaspoon of salt in beer bottle	112	44%	42%	112	51%	43%
10 teaspoons of sugar and 1 teaspoon of salt in beer bottle	100	39%	38%	82	37%	32%
Any other combination	9	4%	3%	7	3%	3%
Don't know	34	13%	13%	20	9%	8%
Subtotal	255	100%	96%	221	100%	85%
No response	11	-	4%	39	-	15%
	266	-	100%	260	-	100%

\*contingency chi-square (respondents): 3.25; degrees of freedom: 3; p=0.35

Care-seeking behaviour was marginally different in both the groups. The use of traditional herbs by the mothers in the treatment of diarrhoea was limited, ranging from only 1% in Gbagi to 2% in Bodija. These figures are much lower than those reported in previous studies (6,7,8). Omotade *et al.* (6) reported that 23% of the cases of diarrhoea seen in a rural part of Oyo State were treated with traditional herbal medicine. A study in Ilorin (7) showed that 28% of the mothers used herbs in the treatment of diarrhoea, while Ogbuagu (8) reported that 7% of the educated mothers in Eastern Nigeria used herbs. The reason for the much lower percentage of the mothers who used herbs in this study may be related to the increased knowledge of proper management of diarrhoea, especially with the introduction of

oral rehydration therapy into our primary healthcare programme.

In conclusion, this study shows that most mothers were knowledgeable about the important causes of diarrhoea and the use of ORS in its management. It is noteworthy that while about 90% of the respondents in both markets knew about the components and about 85% knew the exact composition of SSS, only one-third of our subjects resorted to its use at home in the treatment of their children with diarrhoea. There is, therefore, need to continue to encourage mothers in the use of ORS during bouts of diarrhoea, and such a practice may be reinforced by continuous health education and home visiting by health workers to ensure the correct management of diarrhoea at home.

**Table VII.** Care-seeking practices

Response	Bodija			Gbagi		
	No.*	% Subtotal	% Total	No.*	% Subtotal	% Total
Health centre/clinic/hospital	97	44%	36%	74	40%	28%
ORT home solution	73	33%	27%	59	32%	23%
Chemist to buy drugs	27	12%	10%	35	19%	13%
Used drugs prescribed for previous episode	16	7%	6%	10	5%	4%
Traditional herbalist	5	2%	2%	2	1%	1%
Native herbs	3	1%	1%	6	3%	2%
	221	100%	83%	186	100%	72%
No response	45	-	17%	74	-	28%
	266	-	100%	260	-	100%

\*contingency chi-square (responders): 6.32; degrees of freedom: 5; p=0.28

The Federal Ministry of Health recommends the use of SSS rather than the pre-packed ORS for home management of diarrhoea. Mothers' knowledge about the composition of SSS was commendable. Over 80% of our total study population correctly indicated the composition of SSS (Table VI). Ekanem *et al.* (9) reported that only 24% of the 274 mothers in their study gave a correct description of the composition of SSS. However, their study showed that correct knowledge did not necessarily translate to correct practice in the preparation of the solution. In our study, mothers aged less than 30 years were more knowledgeable about the composition of SSS. This may be a reflection of recent health education efforts at health centres and antenatal clinics.

#### ACKNOWLEDGEMENTS

This work was supported by a Senate Research Grant from the University of Ibadan, Nigeria.

#### REFERENCES

1. Nigeria. Federal Office of Statistics. Nigeria demographic and health survey 1990. DHS IRD/Macro International, Inc 1992.
2. Oyejide CO, Fagbemi AH. An epidemiological study of rotavirus diarrhoea in a cohort of Nigerian infants. II. Incidence of diarrhoea in the first 2 years of life. *Int J Epidemiol* 1988;17:908-12
3. Jinadu MK, Olusi SO, Agun JI, Fabiyi AK. Childhood diarrhoea in rural Nigeria. I. Studies on prevalence, mortality and socio-environmental factors. *J Diarrhoeal Dis Res* 1991;9:323-7.
4. Henry FJ. Bridging the knowledge-practice gap in the management of childhood diarrhoea in Nigeria. *Nigerian J Paediatr* 1994;21(suppl):1-8.
5. Elegbe IA, Ojofeitimi EO, Elegbe I, Akinola MO. Pathogenic bacteria isolated from infants feeding teats. Contamination of teats used by illiterate and educated nursing mothers in Ile-Ife, Nigeria. *Am J Dis Child* 1982;136:672-4.
6. Omotade OO, Kayode CM, Dare OO, Oladepo O, Adeyemo AA. Perceptions and first line home treatment of diarrhoea diseases in Ona-Ara Local Government Area of Oyo State. *Nigerian J Paediatr* 1994;21(suppl):80-7.

7. Oni GA, Schumann DA, Oke EA. Diarrhoeal disease morbidity, risk factors and treatments in a low socio-economic area of Ilorin, Kwara State, Nigeria. *J Diarrhoeal Dis Res* 1991;9:250-7.
8. Ogbuagu KF, Eneanya CI, Ebenabe C. Igbo mothers' perception and treatment of diarrhoea in Eastern Nigeria. *Nigerian J Paediatr* 1994;21(suppl):30-8
9. Ekanem EE, Akitoye CO, Adedeji OJ, Salako QA. A quantitative assessment of the Nigerian's mother's ability to prepare salt sugar solution for the home management of diarrhoea. *J R Soc Health* 1993;113:243-6

SHORT REPORT

## An Outbreak of Food Poisoning Associated with Restaurant-made Mayonnaise in Abha, Saudi Arabia

KHALID SAEED AL-AHMADI, HASSAN E EL BUSHRA, AND ALI SAEED AL-ZAHRANI

*Saudi Arabian Field Epidemiology Training Program, PO Box 6344, Riyadh 11442,  
Kingdom of Saudi Arabia*

### Abstract

**In May 1996, an outbreak of gastroenteritis occurred among customers who bought dinner from a restaurant that specialised in fried chicken in Abha city, south-west Saudi Arabia. The median incubation period was 10 hours (range: 3 to 27 hours). Of the 10 food items served, only mayonnaise (RR 2.52; 95% CI 1.71-3.73) and minced garlic (RR 1.20; 95% CI 1.02-1.41) were associated with cases. *Salmonella enterica* was isolated from 124 (84%) of the 159 persons with symptoms of food poisoning, and 91 (73%) were serogroup Enteritidis, phage type B 14. Mayonnaise was prepared in the restaurant using a regular blender. Minced garlic was prepared with the same blender immediately after making the mayonnaise. Unsafe storage of the mayonnaise at room temperature for a median of 6 hours could have resulted in overgrowth of bacteria and a high infective dose of bacteria per serving.**

*Key words:* *Salmonella* food poisoning; *Salmonella enterica*; Gastroenteritis; Disease outbreaks; Retrospective studies; Cohort studies

### INTRODUCTION

*Salmonella* spp., a common cause of food poisoning, are usually found in poultry, uncooked eggs, raw milk, and meat. Other foods, including fruits, vegetables, and pasteurised milk, may be cross-contaminated (1,2). Many *Salmonella* spp., such as *Salmonella enterica* serotype *enteritidis*, infect poultry, and can be transmitted via chickens' ovarian canals to eggs' contents. (3). Food items containing raw eggs, eg. home-made ice-cream, home-made mayonnaise, cookie batter, and hollandaise sauce, have been implicated in many food poisoning outbreaks (1). About  $10^3$ - $10^5$  *Salmonella* bacilli must be ingested to produce an illness (4). However, the minimum infective dose for non-typhoidal salmonellosis differs considerably with the pathogen and with host-associated factors. Some studies have reported very low

infective doses: 60 to 65 cells of *S. eastbourne* from chocolate, one to six cells of *S. nima* also from chocolate, and a similar, very low number of *S. typhimurium* organisms from cheddar cheese (5).

On 7 May 1996, an outbreak of gastroenteritis occurred in Abha city, Assir region, south-west Saudi Arabia, among customers who bought dinner from a restaurant "A" that specialises in fried chicken. On that day, the restaurant almost exclusively served students from a high school in the city. A retrospective cohort study was conducted to determine the extent and the source of the outbreak.

---

Correspondence and reprint requests should be addressed to: Dr. Hassan E El Bushra  
PO Box 62281, Riyadh 11585  
Saudi Arabia  
Telephone and Fax: 00-996-1-496-0163  
e-mail: fetp@naseej.com



## SUBJECTS AND METHODS

A case of food poisoning was defined as a person who developed acute diarrhoea and abdominal pain, with fever, nausea or vomiting within 72 hours of eating a meal prepared at the take-away restaurant "A" on 7 May 1996, and in whom a *Salmonella* sp. was isolated from stool culture or rectal swab.

We obtained a list of all patients showing signs and symptoms compatible with food poisoning and who had been admitted to all hospitals in Abha city and neighbouring towns on May 7 and up to 10 days later. Only cases that met the case definition were included. The results of bacteriologic tests were abstracted from medical records as were the patients' gender and occupation. The information allowed us to completely construct a retrospective cohort.

Patients were interviewed directly or over the phone and were questioned about the date and time of eating dinner, symptoms, and food items eaten at dinner from the restaurant. We visited the restaurant to identify procedures, storage and handling of cooked foods. The total number of meals sold on May 7 was obtained. *Salmonella* spp. isolated from study patients at Abha Central Hospital were taken to King Khalid University Hospital (KKUH) in Riyadh for serotyping. Three bacterial isolates, randomly selected, were phage-typed at the Centers for Diseases Control and Prevention (CDC), Atlanta, U.S.A. We calculated the attack rate (AR) and the relative risk (RR) and the 95% confidence interval (95% C.I.) for each food item.

## RESULTS

During the outbreak, 228 persons who had eaten a meal bought at restaurant "A" on May 7, and subsequently presented with acute diarrhoea were admitted to hospital; 200 (88%) were males, and 28 (12%) females. The mean

(SD) age of the patients was 19 (9) years (range: 1 to 60). *Salmonella* spp. were isolated from 124 (78%) of the 159 faecal specimens; 91 of these isolates (73%) were *S. enteritidis*; the remaining 33 isolates were reported as *Salmonella enterica*. The three isolates sent to the CDC proved to be *S. enteritidis*, phage type B14.

**Table.** Diarrhoea cases by foods eaten from restaurant "A", Abha city, Saudi Arabia, May 1996

Food item	No. of persons who ate listed food		No. of persons that did not eat listed food		Relative risk	95% confidence interval	p value
	Ill	Not ill	Ill	Not ill			
Mayonnaise	108	7	16	27	2.5	1.7-3.7	<0.001
Minced garlic	63	10	61	24	1.2	1.0-1.4	0.027
Fried potato	121	32	3	2	1.3	0.6-2.7	NS
Chicken	122	33	2	1	1.2	0.5-2.6	NS
Cucumber	86	20	36	16	1.2	1.0-1.4	NS
Chickpea salad	65	14	59	20	1.1	0.9-1.3	NS
Tomato	72	18	50	18	1.1	0.9-1.3	NS
Lettuce	63	17	59	19	1.0	0.9-1.2	NS
Bread	104	30	18	6	1.0	0.8-1.3	NS
Ketchup	42	14	82	20	0.9	0.8-1.1	NS

NS = Not significant

The median incubation period was 10 hours (range: 3 to 27 hours). The epidemic curve suggested a common source for the outbreak (Fig.).

Among the 10 food items eaten, mayonnaise had the highest relative risk (RR 2.52; 95% C.I. 1.7-3.7) with a very significant  $\chi^2$  of 59.29 ( $p < 0.001$ ), followed by minced garlic (RR 1.2; 95% C.I. 1.02-1.4;  $\chi^2 = 4.91$ ;  $p = 0.027$ ) (Table). The restaurant had, as usual, prepared its own mayonnaise with fresh eggs and lemon-flavoured salt instead of vinegar, using a regular blender. Minced garlic was prepared with the same blender immediately after making the mayonnaise. The mayonnaise and minced garlic were stored as unit servings in little plastic containers and kept at room temperature for a median of 6 hours before being served for dinner.

## DISCUSSION

This study demonstrates that the outbreak was probably caused by the restaurant-made mayonnaise, prepared

from infected eggs. Minced garlic, which was prepared immediately after and in the same blender used in preparing mayonnaise, was most likely cross-contaminated. Moreover, unsafe storage of the mayonnaise and minced garlic at room temperature could have resulted in overgrowth of the bacteria. The relatively short incubation period suggests a high infective dose. We could not look for the presence of *Salmonellae* in the mayonnaise or garlic implicated in this study, because there were no leftovers.

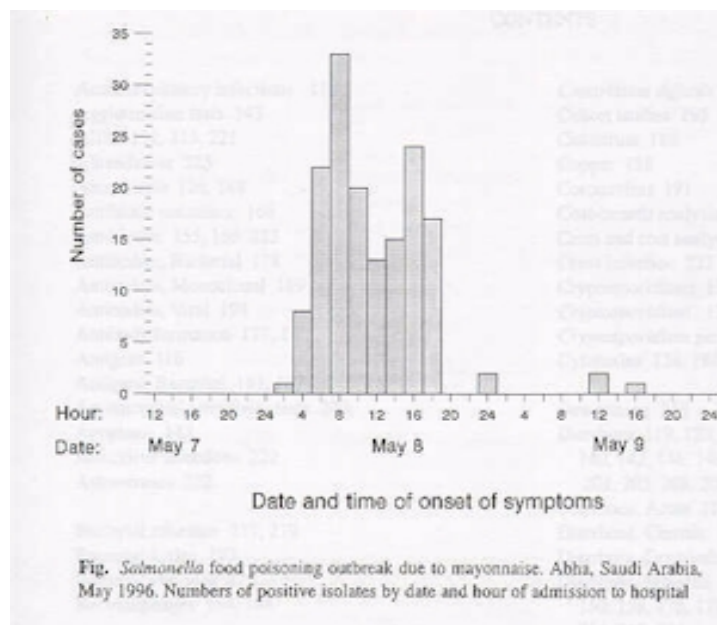


Fig. *Salmonella* food poisoning outbreak due to mayonnaise. Abha, Saudi Arabia, May 1996. Numbers of positive isolates by date and hour of admission to hospital

Mayonnaise has been associated with outbreaks of salmonellosis in the USA, especially during the summer months, when the temperature promotes rapid bacterial multiplication during production, transport, or storage of food items containing mayonnaise (6). In Spain, health education, and national and regional laws that allow use of only commercial mayonnaise in restaurants, have resulted in a decrease of food poisoning outbreaks associated with *S. enteritidis* over a five-year period (6).

*Salmonella* cell counts inside contaminated eggs have been reported to rise 1.2 to 1.3 log after 24 hours of incubation at 21 °C; and when these eggs were used for making mayonnaise, the cell count rose by 1.6 log after 2 hours of incubation at 37 °C (7). It is recommended that eggs be refrigerated after purchase to reduce the hazards

resulting from contaminated eggs with quickly increasing numbers of bacteria (8).

In Riyadh city, most outbreaks of food poisoning have been attributed to *Salmonella* spp. Chicken sandwiches with mayonnaise, a popular fast food, were repeatedly implicated (9). Unfortunately, there are no data available in Saudi Arabia on the use of restaurant-made mayonnaise. It is recommended that restaurants use pasteurised eggs, according to the recommendation of the Saudi Arabian Standards Organisation, or commercial mayonnaise. Food handlers need to be educated on, and inspected for, proper storage and handling of food.

This outbreak illustrates the growing need in Saudi Arabia for a reference Public Health Laboratory that could phage-type food-borne pathogens, such as *Salmonellae*

#### ACKNOWLEDGEMENTS

We are grateful to Dr. Abdulaziz Al-Huzaim, Director General, Health Affairs, Asir region and Dr. Abdel Majeed Kambal, Department of Bacteriology, King Khalid University Hospital, King Saud University, Riyadh, for their help. We are indebted to Mr. Ali Al-Shahrani, Head, Preventive Medicine Department, Asir Health Affairs, Asir region and to Mr. Munirrah Al-Gahtani,

Infection Control Nurse, Asir Central Hospital for their great assistance.

#### REFERENCES

1. Buckner P, Ferguson D, Anzalone D, Taylor J. Outbreak of *Salmonella enteritidis* associated with homemade ice cream, Florida, 1993. *MMWR* 1994;43:669-71.
2. Hornick RB. Nontyphoidals salmonellosis. In: Hoepflich PD, editor. *Infectious diseases*. Philadelphia: Harper and Row, 1983:655-61.
3. Mishu B, Griffin PM, Tauxe RV, Cameron DN, Hutcheson RH, Schaffner W. *Salmonella enteritidis* gastroenteritis transmitted by intact chicken eggs. *Ann Intern Med* 1991;115:190-4.
4. Guthrie RK. Salmonellosis – the infection. In: *Salmonella*. Boca Raton: CRC Press, 1992:41-63.

5. Mintz ED, Cartter ML, Hadler JL, Wasell JT, Zingeser JA, Tauxe RV. Dose-response effects in an outbreak of *Salmonella enteritidis*. *Epidemiol Infect* 1994;112:13-23.
6. Usera MA, Cano R and Echeita A. Analysis of *Salmonella* spp. serotypes isolated in Spain in 1988-1992. . *Enferm Infec Microbiol Clin* 1995;13:138-45.
7. Ruzickova V. Growth and survival of *Salmonella enteritidis* in selected egg food. *Vet Med Praha*. 1994;39:187-95.
8. Humphrey TJ, Martin KW, Whitehead A. Contamination of hands and surfaces with *Salmonella enteritidis* PT4 during the preparation of egg dishes. *Epidemiol Infect* 1994;113:403-9.
9. Jarallah JS, Khaja TA, Izonirly MAG. Reports of bacterial food poisoning in the Riyadh region of Saudi Arabia: a one year retrospective study. *Saudi Med J* 1993;14:46-9.

**BIBLIOGRAPHY ON DIARRHOEAL DISEASES**

Compilers:

M Shamsul Islam Khan<sup>1</sup>,  
M Nazimuddin<sup>2</sup>, and  
M Al Mamun<sup>3</sup>

## CONTENTS

- Acute respiratory infections 118  
 Agglutination tests 143  
 AIDS 132, 213, 221  
 Albendazole 225  
 Amoebiasis 126, 148  
 Antibiotic resistance 166  
 Antibiotics 155, 166, 223  
 Antibodies, Bacterial 178  
 Antibodies, Monoclonal 189  
 Antibodies, Viral 198  
 Antibody formation 177, 197  
 Antigens 116  
 Antigens, Bacterial 161, 167  
 Antimicrobial sensitivity tests 220  
 Apoptosis 142  
 Astrovirus infections 222  
 Astroviruses 222
- Bacterial adhesion 217, 219  
 Bacterial toxins 193  
 Bacterial vaccines 173  
 Bacteriophages 164, 184
- Campylobacter* 202, 215  
*Campylobacter fetus* 220  
*Campylobacter jejuni* 158, 161  
 Case-control studies 146  
 Child nutrition disorders 123, 134  
 Child nutritional status 134  
 Cholecystitis 230  
 Cholera 114, 117, 137, 141, 164, 168, 176, 180, 183,  
 185, 189, 194, 197, 199, 207, 210  
 Cholera toxin 141, 152, 202, 207, 209  
 Cholera vaccine 137, 176, 194  
 Clindamycin 130
- Clostridium difficile* 125, 130, 135, 163, 212, 229, 231  
 Cohort studies 195  
 Colostrum 188  
 Copper 128  
 Coronavirus 191  
 Cost-benefit analysis 218  
 Costs and cost analysis 130, 212  
 Cross infection 222  
 Cryptosporidiosis 139, 162, 182, 188, 213, 221,  
*Cryptosporidium* 139, 182, 188, 221  
*Cryptosporidium parvum* 115, 162, 188  
 Cytotoxins 124, 184, 193
- Deworming 216  
 Diarrhoea 119, 120, 125, 129, 130, 132, 133, 135, 138,  
 140, 142, 146, 149, 150, 151, 160, 163, 171, 179, 196,  
 201, 205, 208, 209, 212, 213, 221, 226, 227, 231  
 Diarrhoea, Acute 116, 118, 123, 128, 144, 180, 222  
 Diarrhoea, Chronic 131, 143, 145, 222  
 Diarrhoea, Drug induced 155, 223  
 Diarrhoea, Infantile 116, 118, 121, 122, 123, 128, 134,  
 150, 158, 170, 172, 177, 178, 187, 190, 195, 198, 204,  
 214, 218, 224  
 Diarrhoea management 206, 208  
 Diarrhoea, Persistent 122  
 Diarrhoea, Veterinary 115, 154, 173, 191  
 Diarrhoeal diseases 174, 178, 203  
 Diet 120, 123, 149  
 Disease models, Animal 173, 209, 229  
 Disease outbreaks 210, 211  
 Double-blind method 133, 156, 218  
 Drug resistance, Microbial 166  
 Dysentery, Bacillary 156, 157, 165, 166, 175, 178, 186,  
 228, 233

<sup>1</sup>Head, Dissemination and Information Services Centre (DISC), ICDDR,B, GPO Box 128, Dhaka, Bangladesh<sup>2</sup>Librarian<sup>3</sup>Library Assistant

- Electrophoresis, Pulse-field, Gel 215  
*Entamoeba histolytica* 126, 148, 153  
Enteral nutrition 133  
Enteritis 161, 229  
Enterocolitis 223  
*Enterocytozoon bieneusi* 132, 145  
Enteropathogens 134  
Enterotoxins 138, 173  
Enzyme-linked immunosorbent assay 182  
*Escherichia coli* 173, 181, 193, 195  
*Escherichia coli*, Enteroaggregative 138, 142, 146, 226  
*Escherichia coli*, Enterohaemorrhagic 119, 124, 184, 192  
*Escherichia coli*, Enteropathogenic 119
- Fatty acids, Volatile 155  
Follow-up studies 224
- Gastroenteritis 169, 211  
Genes, Bacterial 167, 168, 184, 186  
Gentamicin 165  
*Giardia lamblia* 126  
Giardiasis 126  
Glutamine 136, 209
- Haemagglutinins 164, 232  
Haemolysins 124, 142, 147, 189  
Haemolytic-uraemic syndrome 179  
*Helicobacter* infections 176  
*Helicobacter pylori* 202  
HIV 129, 132, 145  
HIV infections 131, 194, 226
- Immune response 116, 148, 159, 177, 191, 197, 224  
Immunoglobulins 188  
Immunohistochemistry 154  
Infant growth 170  
Infant mortality 114  
Infant, Low birth weight 170  
Intestinal absorption 209  
Intestinal diseases, Parasitic 225  
Iron deficiency 216
- Knowledge, attitudes, practice 121
- Lactadherin 187  
Lactose 128  
Longitudinal studies 172  
Lymphocytes 115
- Microbial sensitivity tests 166, 207  
Microsporidiosis 131, 132, 145  
Milk, Human 187
- Morbidity 118, 170, 190, 203  
Myotonia atrophica 201
- Neoplasms 205  
Neutrophils 143  
Nitric oxide 232  
Norfloxacin 180  
Nucleotide sequence 168  
Nutrition disorders 120, 149
- Oral rehydration solutions 120, 136, 149, 160, 200, 209, 227  
Oral rehydration therapy 120, 149, 200, 227
- Plasmids 124  
Polymerase chain reaction 145  
Prescriptions, Drug 121
- Randomized controlled trials 156, 194, 218  
Respiratory tract infections 150  
Review literature 120, 140, 144, 149, 174, 193, 199  
Rice 160  
Rotavirus 127, 172, 177, 187, 190, 196, 198, 204, 211, 214, 218, 224  
Rotavirus infections 159, 172, 187, 198, 214  
Rotavirus vaccine 218  
Roxithromycin 213, 221
- Salmonella* 169, 178  
Seasonal variation 131, 196  
Septicaemia 230  
Serotonin 205  
Serotyping 172, 215  
*Shigella* 178  
*Shigella flexneri* 157, 165, 228, 233  
*Shigella sonnei* 157, 167, 175, 186  
Slums 151  
Starch 227  
Statistics 196
- Tetracycline 180  
Training support 206
- Verocytotoxins 192  
*Vibrio cholerae* 117, 141, 152, 164, 168, 180, 183, 185, 189, 197, 199, 207, 210, 217, 219, 230, 232  
*Vibrio parahaemolyticus* 147, 181  
Viral vaccines 159, 224  
Virulence 119, 125, 153, 162, 217, 219, 233  
Vitamin A 122, 156
- Zinc 118, 122, 128, 144, 170  
Zinc deficiency 118

## BIBLIOGRAPHY ON DIARRHOEAL DISEASES

**114 Ackers M-L, Quick RE, Drasbek CJ, Hutwagner L, Tauxe RV. Are there national risk factors for epidemic cholera? The correlation between socioeconomic and demographic indices and cholera incidence in Latin America. Int J Epidemiol 1998 Apr;27(2):330-4. 8 ref, Eng.** Foodborne and Diarrheal Diseases Branch, Division of Bacterial and Mycotic Diseases, National Center for Infectious Diseases, Centers for Disease Control and Prevention, 1600 Clifton Road, NE, Mailstop A-38, Atlanta, GA 30333, USA

**“Background:** From 1991 through 1995, all Latin American countries maintained cholera surveillance systems to track the epidemic that entered the region through Peru in January 1991. These data were used to assess correlations between socioeconomic and demographic indices that might serve as national risk predictors for epidemic cholera in Latin America. **Methods:** Correlations between country-specific cumulative cholera incidence rates from 1991 through 1995 and infant mortality, the Human Development Index ([HDI] a numerical value based on life expectancy, education, and income), gross national product (GNP) per capita, and female literacy were tested using the Pearson correlation coefficient. **Results:** A total of 1,339,834 cholera cases with a cumulative incidence rate of 183 per 100,000 population were reported from affected Western Hemisphere countries from 1991 through 1995. Infant mortality rates were the most strongly correlated with cumulative cholera incidence based on the Pearson correlation coefficient. The HDI had a less strong negative correlation with cumulative cholera incidence. The GNP per capita and female literacy rates were weakly and negatively correlated with cholera cumulative incidence rates. **Conclusions:** Infant mortality and possibly the HDI may be useful indirect indices of the risk of sustained transmission of cholera within a Latin American country. Cumulative cholera incidence is decreased particularly in countries with infant mortality below 40 per 1000 live births. The lack of reported cholera cases in Uruguay and the Caribbean may reflect a low risk for ongoing transmission, consistent with socioeconomic and demographic indices. Cholera surveillance remains an

important instrument for determining cholera trends within individual countries and regions.”

**115 Aguirre SA, Perryman LE, Davis WC, McGuire TC. IL-4 protects adult C57BL/6 mice from prolonged *Cryptosporidium parvum* infection: analysis of CD4<sup>+</sup> a<sub>b</sub><sup>+</sup> IFN- $\gamma$ <sup>+</sup> and CD4<sup>+</sup> a<sub>b</sub><sup>+</sup> IL-4<sup>+</sup> lymphocytes in gut-associated lymphoid tissue during resolution of infection. J Immunol 1998 Aug 15;161(4):1891-900. 57 ref, Eng.** Department of Microbiology and Immunology, D331 Fairchild Science Building, Stanford University School of Medicine, Stanford, CA 94305, USA

**116 Ahmed T, Sumazaki R, Shin K, Nagai Y, Shibasaki M, Fuchs GJ, Takita H. Humoral immune and clinical responses to food antigens following acute diarrhoea in children. J Paediatr Child Health 1998 Jun;34(3):229-32. 22 ref, Eng.** International Centre for Diarrhoeal Disease Research, Bangladesh, GPO Box 128, Dhaka 1000, Bangladesh

**“Objective:** To investigate the effect of acute watery diarrhoea in children upon humoral immune responses to food antigens and the subsequent development of food allergy. **Methodology:** Serum antibodies to cows’ milk,  $\beta$ -lactoglobulin,  $\alpha$ -lactalbumin, bovine serum albumin and ovalbumin were measured in 30 children with acute diarrhoea in the acute phase and 1 month after recovery. The children were followed for 1 year to assess the development of food allergy. **Results:** IgG anti $\beta$ -lactoglobulin titres for the study group increased 1 month after recovery compared to the titres during the acute phase ( $p=0.02$ ). Antibody concentration for the other antigens studied did not rise. Four children developed positive IgE antibodies to one or more of the allergens after the diarrhoeal episode, although the titres were very low. None showed evidence of allergy to cows’ milk or egg during the year-long follow-up. **Conclusions:** Acute diarrhoea in children resulted in increased production of IgG antibody to  $\beta$ -lactoglobulin and had a priming effect for development of positive IgE antibody to cows’ milk. Clinical food allergy was not observed in any of the children during the year-long follow-up.”

**1 1 7 Aidara A, Koblavi S, Boye CS, Raphenon G, Gassama A, Grimont F, Grimont PAD. Phenotypic and genotypic characterization of *Vibrio cholerae* isolates from a recent cholera outbreak in Senegal: comparison with isolates from Guinea-Bissau. Am J Trop Med Hyg 1998 Feb;58(2):163-7. 23 ref, Eng.** Institut Pasteur, 36 Avenue Pasteur, BP 220, Dakar, Senegal

“A total of 127 strains of *Vibrio cholerae* (177 *V. cholerae* O1 and 10 nonagglutinating strains) isolated from a recent cholera outbreak in Senegal and four strains isolated in Guinea-Bissau (during the survey of a cholera epidemic that occurred 10 months before the Senegalese one) were analyzed. Strains were characterized by conventional methods (biochemical and serologic identification, susceptibility to antimicrobial agents), polymerase chain reaction for genes encoding cholera toxin (CtxA), zonula occludens toxin (Zot), and accessory cholera enterotoxin (Ace), and by ribotyping. Conventional methods showed that all strains of *V. cholerae* O1 belonged to serotype Ogawa, biotype El Tor and were resistant to the vibriostatic agent O129 (2,4-diamino 6,7-diisopropylpteridine phosphate), cotrimoxazole, and chloramphenicol; all strains were sensitive to tetracycline, a drug that has been extensively used in cholera therapy. Most of these *V. cholerae* O1 (112 strains from Senegal and four strains from Guinea-Bissau) had an intact core region (virulence cassette) and amplified a 564-basepair (bp) fragment of *ctxA*, a 1083-bp fragment of *zot*, and a 314-bp fragment of *ace*. Ribotyping of *V. cholerae* O1 strains after *Bgl*I restriction of total DNA revealed that ribotype B5a, which is the predominant ribotype of this seventh pandemic of cholera, was not isolated. Instead, a new ribotype was identified and designated B27 in our data bank. Since O1 isolates from Guinea-Bissau and Senegal have the same biotype, serotype, and ribotype and as the Guinea-Bissau outbreak that preceded the one in Senegal, this emerging ribotype probably came from Guinea-Bissau. Nonagglutinating strains exhibited no resistance to the O129 agent and to the tested antibiotics, they were all negative for virulence cassette, except for one strain with the *ctxA* and *zot* genes isolated from a patient with diarrhea, and there was a great variability of ribotypes among these strains. There was no difference between environmental O1 strains isolated from water and strains isolated from patients with cholera, suggesting that fecally contaminated water is an important reservoir for infection.”

**1 1 8 Bahl R, Bhandari N, Hambidge KM, Bhan MK. Plasma zinc as a predictor of diarrheal and respiratory morbidity in children in an urban slum setting. Am J Clin Nutr 1998 Aug;68(Suppl 2):414-7. 26 ref, Eng.** Department of Pediatrics, All India Institute of Medical Sciences, Ansari Nagar, New Delhi 110029, India

“The association between low initial plasma zinc concentration and risk of morbidity over the subsequent 3 mo was examined in a cohort of 116 children aged 12-59 mo recovering from acute diarrhea. Children with low initial plasma zinc ( $\bar{X}$  8.4  $\mu\text{mol/L}$ ) had more episodes of diarrhea [risk ratio (RR): 1.47; 95% CI: 1.03, 2.49] and severe diarrhea, defined as passage of  $\geq 5$  liquid stools in a 24-h period, (RR: 1.70; 95% CI: 1.06, 2.72) than did children with normal plasma zinc ( $> 8.4 \mu\text{mol/L}$ ). The mean prevalence rate of diarrhea associated with fever was 4 times higher in the zinc-deficient group ( $p=0.01$ ). Overall, the difference in the number of episodes of acute lower respiratory tract infections (ALRIs) between the two groups was not statistically significant (RR: 1.76; 95% CI: 0.88-3.53) but the mean prevalence rate of ALRIs was 3.5 times higher in children with low plasma zinc ( $p=0.05$ ). The increased risk of diarrhea and ALRIs episodes in zinc-deficient children was larger in boys than in girls. These results show that children with low plasma zinc concentrations are at risk for increased diarrheal and respiratory morbidity.”

**1 1 9 Bain C, Keller R, Collington GK, Trabulsi LR, Knutton S\*. Increased levels of intracellular calcium are not required for the formation of attaching and effacing lesions by enteropathogenic and enterohemorrhagic *Escherichia coli*. Infect Immun 1998 Aug;66(8):3900-8. 33 ref, Eng.** \*Institute of Child Health, University of Birmingham, Clinical Research Block, Whittal St., Birmingham B4 6NH, UK

“Elevated concentrations of intracellular calcium ( $[\text{Ca}]_i$ ) have been implicated as an important signalling event during attaching and effacing (A/E) lesion formation by enteropathogenic *Escherichia coli* (EPEC). The highly localized nature of the cytoskeletal and cell surface alterations occurring during A/E lesion formation suggests that there should be equally localized EPEC-induced signalling events. To analyze further the calcium responses to infection of HEp-2 cells by EPEC, we employed calcium-imaging fluorescence microscopy,

which allows both temporal and spatial measurements of  $[Ca]_i$  in live cells. Using this imaging technique, not only were we unable to detect any significant elevation in  $[Ca]_i$  at sites of A/E EPEC adhesion, but, with several different classical EPEC and enterohemorrhagic *E. coli* (EHEC) strains and three different infection procedures, each of which resulted in extensive A/E bacterial adhesion, we were unable to detect any significant alterations in  $[Ca]_i$  in infected cells compared to uninfected cells. In addition, chelation of intracellular free calcium with bis-(aminophenoxy)-ethane-*N, N, N', N'*-tetraacetic acid (BAPTA) did not, as previously reported, prevent A/E lesion formation. We conclude that increased  $[Ca]_i$  are not required for A/E lesion formation by EPEC and EHEC.”

**1 2 0 Baker SS, Davis AM. Hypocaloric oral therapy during an episode of diarrhea and vomiting can lead to severe malnutrition. J Pediatr Gastroenterol Nutr 1998 Jul;27(1):1-5. 40 ref, Eng.** Division of Pediatric Gastroenterology and Nutrition, Medical University of South Carolina, 158 Rutledge Street, Charleston, SC 29403, USA

“**Background:** Malnutrition associated with diarrhea and vomiting can be prevented if the focus of treatment is on nutritional requirements. Some pediatricians inappropriately continue to recommend clear liquids followed by dilute feedings or hypocaloric diets until the diarrhea clears. **Methods:** Medical records were retrospectively reviewed, and the literature was reviewed. **Results:** Severe malnutrition occurred in two children with diarrhea and vomiting who were treated with clear liquids followed by restricted nutrient intake. **Conclusion:** Severe malnutrition associated with diarrhea and vomiting can occur when the prescribed treatment is bowel rest followed by hypocaloric diets until diarrhea clears. Malnutrition can be prevented if the focus of treatment is on nutritional requirements. Current American Academy of Pediatrics recommendations for treatment of diarrhea and vomiting are discussed.”

**1 2 1 Beria JU, Damiani MF, Santos ISD, Lombardi C. Physicians' prescribing behaviour for diarrhoea in children: an ethnoepidemiological study in southern Brazil. Soc Sci Med 1998 Aug;47(3):341-6. 13 ref, Eng.** Departamento de Medicina Social, Universidade Federal de Pelotas, CP 464 Pelotas, RS Brazil

“With the aim of implementing an intervention program on physician's prescribing behaviour for diarrhoea in

children under five, an ethnoepidemiological study was conducted in Pelotas (Brazil), from February to April 1993. Information on prescription of drugs was obtained through record review of 381 cases of diarrhoea provided by 33 medical doctors from eight health centres. Trained field workers observed a total of 54 clinical consultations due to diarrhoea. Brief exit interviews with the mothers were performed just after the observations. Twenty-seven open-ended home interviews were made with the mothers the day after they had been observed. After all observations had been completed, open-ended interviews were conducted with 21 physicians. The results showed that there is a misunderstanding of the role of ORS in the treatment of diarrhoea: mothers want something to “cut” diarrhoea and they notice that ORS does not act in this way and doctors do not explain the action of ORS in diarrhoea management. Comparing with record reviews, during observations a child had a lower probability of receiving an antibiotic or antidiarrheal drug prescription. This finding indicates that other variables than technical skills are involved in doctor's prescribing behaviour. A lack of ability or of motivation to deal with “anxious or difficult mothers” led some doctors to enhance antibiotic or other non-recommended drugs to manage diarrhoea. Therefore, efforts to improve the quality of case management of diarrhoea, through intervention programmes in the government health sector, are needed in Pelotas.”

**1 2 2 Bhan MK, Bhandari N. The role of zinc and vitamin A in persistent diarrhea among infants and young children. J Pediatr Gastroenterol Nutr 1998 Apr;26(4): 446-53. 78 ref, Eng.** Division of Gastroenterology and Nutrition, Department of Pediatrics, All India Institute of Medical Sciences, New Delhi 110029, India

**1 2 3 Bhatnagar S, Singh KD, Sazawal S, Saxena SK, Bhan MK. Efficacy of milk versus yogurt offered as part of a mixed diet in acute noncholera diarrhea among malnourished children. J Pediatr 1998 Jun;132(6):999-1003. 23 ref, Eng.** Division of Gastroenterology, Hepatology, and Nutrition, Department of Pediatrics, Indian Council of Medical Research Advanced Centre for Diarrheal Disease Research, All India Institute of Medical Sciences, Ansari Nagar, New Delhi 110029, India

“We compared the clinical outcome of acute diarrhea in 96 malnourished boys (aged 4 to 47 months) receiving full-strength milk compared with yogurt offered as part



of a mixed diet. All had weight for height less than or equal to 80% of the National Centre for Health Statistics median. They were randomly assigned to receive milk formula (MF; 67 cal/100 ml) or yogurt formula (YF; prepared from the same milk formula) at the rate of 120 ml/kg body weight in seven divided feedings. Stool-reducing substances (>1%) were detected more frequently in the MF group, and the differences were significant for day 3 of the study ( $p=0.04$ ). However, the geometric mean (95% confidence interval) of the total stool weights (gm/kg) during 0 to 72 hours (MF 128.8 [103, 161.4]; YF 110.9 [87, 142.2]) was comparable ( $p=0.37$ ) as was the median (range) duration of diarrhea (hours) (MF 45 [4, 183]; YF 52 [7, 173]  $p=0.94$ ). The treatment failure rates in the MF (8.2%) and YF (6.3%) groups were also similar ( $p=0.67$ ). The children consuming milk had higher median percent weight gain at the end of 72 hours of the study ( $p=0.04$ ) and at recovery ( $p=0.02$ ). Routine substitution of yogurt as small frequent feedings as an addition for semisolid food to malnourished children with acute diarrhea does not achieve any significant clinical benefit versus milk."

**1 2 4 Boerlin P, Chen S, Colbourne JK, Johnson R, Grandis SD, Gyles C. Evolution of enterohemorrhagic *Escherichia coli* hemolysin plasmids and the locus for enterocyte effacement in Shiga toxin-producing *E. coli*. Infect Immun 1998 Jun;66(6):2553-61. 56 ref, Eng.** Department of Pathobiology, Ontario Veterinary College, University of Guelph, Guelph, Ontario N1G 2W1, Canada

**1 2 5 Borriello SP. Pathogenesis of *Clostridium difficile* infection. J Antimicrob Chemother 1998 May;41(Suppl C):13-9. 74 ref, Eng.** Central Public Health Laboratory, 61 Colindale Avenue, London NW9 5HT, UK

**1 2 6 Brickfield FX, Gebreegzi M, Beyene A. Incidence of protozoal diarrheal disease in an expatriate community in Addis Ababa. Ethiop Med J 1996 Apr;34(2):107-15. 13 ref, Eng.** Medical Unit, U.S. Embassy Addis Ababa, PO Box 1014, Addis Ababa, Ethiopia

**1 2 7 Bridger JC, Tauscher GI, Desselberger U. Viral determinants of rotavirus pathogenicity in pigs: evidence that the fourth gene of a porcine rotavirus confers diarrhea in the homologous host (note). J Virol 1998 Aug;72(8):6929-31. 21 ref, Eng.** Department of Pathology and Infectious Diseases, The Royal Veterinary College, University of London, London NW1 0TU, UK

**1 2 8 Castillo-Durán C, Venegas G, Villalobos JC, Gatica L, Rodriguez A. Trace mineral balance in acute diarrhea of infants association to etiological agents and lactose content of formula. Nutr Res 1998 May;18(5):799-808. 32 ref, Eng.** Institute of Nutrition and Food Technology, Universidad de Chile, Casilla 15138-11, Santiago, Chile

"We studied zinc and copper losses during dehydrating acute diarrhea requiring hospitalization, in relation to etiological agents and lactose content of formula, in previously healthy infants. We analyzed 39 male infants, 2-10 mo of age, infected with rotavirus (Rt,  $n=21$ ) or enteropathogenic *E. coli* (EPEC,  $n=18$ ). Metabolic balance studies were carried out during the initial 48 h. (Period 1) and on days 6 and 7 after admission (Period 2). All patients were offered oral rehydration solution (Na 90 mEq/L); refeeding began within 4 h of admission. The infants were randomly assigned to a cow's milk based formula (F I) or to the same formula with previous lactose digestion (F II). Fecal Zn losses were greater than intake and Zn balance was not significantly different in Rt and EPEC infected infants fed any formula, during P 1; apparent mean zinc absorption was over 76% in all the groups during P 2. Zn retentions were, during P 1: Rt, F I  $-53 \pm 39.2$ , Rt, F II  $-43 \pm 42.1$ ; EPEC, F I  $-27 \pm 21.6$ , and EPEC, F II  $-39 \pm 56.5$  mg/kg/d. Fecal Cu losses decreased from P 1 to P 2 ( $p<0.01$ ). Cu retentions remained negative during P1 and P 2. No differences attributable to the diarrheal agents were observed in plasma Zn and Cu levels, but plasma Zn increased from P 1 to P 2 among infants infected with rotavirus and fed lactose formula. We conclude that the considerable Zn and Cu losses for infants with acute diarrhea due to rotavirus and treated with ORS solution and early refeeding, are not different from those of infants infected with enteropathogenic *E. coli* and treated similarly. Copper balances remain negative during recovery from diarrhea. The lactose content of the formula influences plasma zinc and plasma copper levels of infants with acute diarrhea due to rotavirus."

**1 2 9 Chintu C, Dupont HL, Kaile T, Mahmoud M, Marani S, Baboo KS, Mwansa W, Sakala-Kazembe F, Sunkutu R, Zumla A. Human immunodeficiency virus-associated diarrhea and wasting in Zambia: selected risk factors and clinical associations. Am J Trop Med Hyg 1998 Jul;59(1):38-41. 24 ref, Eng.** Center for Infectious Diseases, University of Texas School of Public Health and School of Medicine, Houston, TX 77030, USA

“A significant association was observed among human immunodeficiency virus (HIV)-positive adult cases in Lusaka, Zambia compared with HIV-negative controls for chronic diarrhea (68% versus 22%;  $P < 0.05$ ), weight loss (54% versus 30%;  $P < 0.05$ ), lymphadenopathy (44% versus 15%;  $P < 0.05$ ), and skin eruption (33% versus 7%;  $P < 0.05$ ). Among the HIV-positive children, a higher proportion had clinical evidence of tuberculosis when compared with HIV-negative children (8% versus 1%;  $P < 0.05$ ). The study demonstrated an association between weight loss in HIV-positive adults and children and chronic diarrhea (odds ratio [OR]=12.7, 95% confidence interval [CI] = 6.4-25.5;  $P < 0.001$ ), persistent cough (OR = 7.2, 95% CI = 2.9-14.5;  $P < 0.001$ ), and an age of 31-45 years (OR = 3.8, 95% CI = 1.8-8.3;  $P < 0.01$ ). The factors associated with mortality in HIV positive patients included chronic diarrhea (OR = 7.4, 95% CI = 1.6-34;  $P < 0.01$ ), and lymphadenopathy (OR = 3.89, 95% CI = 1.2-12.2;  $P < 0.04$ ).”

**130** Climo MW, Israel DS, Wong ES, Williams D, Coudron P, Markowitz SM. Hospital-wide restriction of clindamycin: effect on the incidence of *Clostridium difficile*-associated diarrhea and cost. *Ann Intern Med* 1998 Jun 15;128(12, pt 1): 989-95. 27 ref, Eng. Hunter Holmes McGuire Veterans Affairs Medical Center, 1201 Broad Rock Boulevard, Section 111C, Richmond, VA 23249, USA

“**Background:** Widespread antibiotic use has been associated with increases in both bacterial resistance and nosocomial infection. **Objective:** To characterize the impact of hospital-wide clindamycin restriction on the incidence of *Clostridium difficile*-associated diarrhea and on antimicrobial prescribing practices. **Design:** Prospective, observational cohort study. **Setting:** University-affiliated Veterans Affairs Medical Center. **Patients:** Hospitalized patients with symptomatic diarrhea. **Measurements:** Clinical data on individual patients and data on antibiotic use were obtained from hospital pharmacy records. Hospital-wide use of antimicrobial agents was monitored. Isolates of *C. difficile* underwent antimicrobial susceptibility testing and molecular typing. **Results:** An outbreak of *C. difficile*-associated diarrhea was caused by a clonal isolate of clindamycin-resistant *C. difficile* and was associated with increased use of clindamycin. Hospital-wide requirement of approval by an infectious disease consultant of clindamycin use led to an overall reduction in clindamycin use, a sustained reduction in the mean

number of cases of *C. difficile*-associated diarrhea (11.5 cases/month compared with 3.33 cases/month;  $P < 0.001$ ), and an increase in clindamycin susceptibility among *C. difficile* isolates (9% compared with 61%;  $P < 0.001$ ). A parallel increase was noted in the use of and costs associated with other antibiotics with antianaerobic activity, including cefotetan, ticarcillin-clavulanate, and imipenemcilastin. The hospital realized overall cost savings as a result of the decreased incidence of *C. difficile*-associated diarrhea. **Conclusions:** Hospital formulary restriction of clindamycin is an effective way to decrease the number of infections due to *C. difficile*. It can also lead to a return in clindamycin susceptibility among isolates and can effect cost savings to the hospital.”

**131** Contreas CN, Berlin OGW, Lariviere MJ, Pandhumas SS, Speck CE, Porschen R, Nakaya T. Examination of the prevalence and seasonal variation of intestinal microsporidiosis in the stools of persons with chronic diarrhea and human immunodeficiency virus infection. *Am J Trop Med Hyg* 1998 May; 58(5):559-61. 6 ref, Eng. Southern California Permanente Medical Group, Division of Gastroenterology, Los Angeles Medical Center, 1526 Edgemont Street, Los Angeles, CA 90027, USA

“The epidemiology of human microsporidiosis is poorly understood and environmental factors affecting transmission of the organism have not been fully elucidated. Temporal variation in the prevalence of microsporidia in the stool of patients with human immunodeficiency virus (HIV) infection and diarrhea was studied to evaluate the role of water-borne transmission. From January 1993 to December 1996, 8,439 stools from HIV-infected individuals were examined for microsporidia spores in southern California. Yearly positivity rates were 8.8% in 1993, 9.7% in 1994, 6.6% in 1995, and 2.9% in 1996. An analysis for linear trend showed a statistically significant decrease in stool positivity rates over time ( $C^2 = 81.9$ ,  $P = 0.001$ ). No significant seasonal variation in the prevalence of microsporidiosis was seen over that time period. These results suggest the constant presence of microsporidia in the environment, rather than a seasonal association with recreational water use or seasonal contamination of the water supply, and a real decrease in yearly prevalence of microsporidia related diarrhea. Factors related to a progressive decrease in prevalence are subjects of future investigation.”

**1 3 2 Contreas CN, Berlin OGW, Speck CE, Pandhumas SS, Lariviere MJ, Fu C. Modification of the clinical course of intestinal microsporidiosis in acquired immunodeficiency syndrome patients by immune status and anti-human immunodeficiency virus therapy. Am J Trop Med Hyg 1998 May;58(5):555-8. 17 ref, Eng.** Southern California Permanente Medical Group, Division of Gastroenterology, Los Angeles Medical Center, 1526 Edgemont Street, Los Angeles, CA 90027, USA

“The clinical course of 37 *Enterocytozoon bieneusi*-infected acquired immunodeficiency syndrome patients with diarrhea was studied. Parasite clearance was seen in 15 patients (40.5%). Clearance of *E. bieneusi* resulted in a 25-100% reduction in episodes of diarrhea, suggesting that microsporidia are true pathogens. Univariate and multivariate proportional hazards analyses revealed that peripheral blood CD4 cell counts  $< 100/\text{mm}^3$ , the use of two or more antiretroviral medications, and use of a protease inhibitor were statistically associated with decreased time to clearance of *E. bieneusi*. Specific anti-microsporidial therapy (albendazole) was not associated with parasite eradication. Factors related to immunocompetence and human immunodeficiency virus suppression appeared to be important in the clearance of *E. bieneusi*.”

**1 3 3 DeMeo M, Kolli S, Keshavarzian A, Borton M, Al-Hosni M, Dyavanapalli M, Shiao A, Tu N, Frommel T, Zarling E, Goris G, Shawaryn G, Mobarhan S. Beneficial effect of a bile acid resin binder on enteral feeding induced diarrhea. Am J Gastroenterol 1998 Jun;93(6):967-71. 19 ref, Eng.** Loyola University Medical Center, Building 117, Room 22, 2160 S. 1<sup>st</sup> Ave., Maywood, IL 60153, USA

“**Objectives:** Diarrhea is a complication of enteral feeding, occurring in up to 68% of critically ill patients. We hypothesized that prolonged fasting results in abnormal bile acid homeostasis. Subsequent enteral feeding then causes a relative luminal excess of bile acids, which leads to choleric diarrhea. Hence, diarrhea induced by enteral feeding should improve with the use of a bile acid binding agent, such as Colestid Granules. **Methods:** We evaluated the effect of Colestid on enteral feeding-induced diarrhea in a double-blind placebo-controlled study. Nineteen patients who were nil per os (NPO) for 5 days before initiation of enteral feeding were enrolled in the study and treatment continued for 7 days. The severity and frequency of diarrhea were quantified.

Fecal bile acids were measured enzymatically. Stool nutrient loss was measured by fat extraction, microkjeldahl determination of nitrogen, and bomb calorimetry of dried fecal specimens. **Results:** Enteral feeding resulted in a high frequency of diarrhea (95%) at some time during the observation period. The majority of episodes of diarrhea in both groups were of low volume. Colestid significantly decreased the prevalence and severity of diarrhea. Colestid had no significant effect on fecal calorie or nutrient losses. The average bile acid concentration in the stool increased significantly after enteral feeding. **Conclusion:** Enteral feeding-induced diarrhea is, at least in part, due to malabsorption of bile acids. The bile acid resin binding agent Colestid improves diarrhea induced by enteral feeding.”

**1 3 4 Dewan N, Faruque ASG, Fuchs GJ. Nutritional status and diarrhoeal pathogen in hospitalized children in Bangladesh. Acta Paediatr 1998 Jun;87(6): 627-30. 23 ref, Eng.** International Centre for Diarrhoeal Disease Research, Bangladesh, GPO Box 128, Dhaka 1000, Bangladesh

“We studied the relationship between nutritional status and infection due to specific enteropathogens in young children with diarrhoea. Overall, 26% of the children were severely underweight, 27% were severely wasted and 19% were severely stunted. Children with *Shigellae* and *V. cholerae* O1 were significantly more severely underweight, wasted and stunted than those with rotavirus diarrhoea ( $P < 0.0001$ ). Our results indicate that an effective nutrition programme for young children might have greater impact on diarrhoeal illness caused by *Shigella* and *V. cholerae* than by rotavirus diarrhoea.”

**1 3 5 Dhawan B, Chaudhry R. An update on Clostridium difficile infection. Trop Gastroenterol 1997 Oct-Dec;18(4):149-52. 50 ref, Eng.** Department of Microbiology, All India Institute of Medical Sciences, Ansari Nagar, New Delhi 110029, India

**1 3 6 Duggan C. Glutamine-based oral rehydration solutions: the magic bullet revisited? (editorial) J Pediatr Gastroenterol Nutr 1998 May;26(5):533-5. 23 ref, Eng.** Gastroenterology and Nutrition, Children's Hospital, 300 Longwood Avenue, Boston, MA 02115, USA

**1 3 7 Durham LK, Longini IM, Jr.\*, Halloran ME, Clemens JD, Nizam A, Rao M. Estimation of vaccine efficacy in the presence of waning: application to cholera vaccines. Am J Epidemiol 1998**

**May;147(10):948-59. 18 ref, Eng.** \*Department of Biostatistics, The Rollins School of Public Health, Emory University, Atlanta, GA 30322, USA

“The authors present a nonparametric method for estimating vaccine efficacy as a smooth function of time from vaccine trials. Use of the method requires a minimum of assumptions. Estimation is based on the smoothed case hazard rate ratio comparing the vaccinated with the unvaccinated. The estimation procedure allows investigators to assess time-varying changes in vaccine-induced protection, such as those produced by waning and boosting. The authors use the method to reanalyze data from a vaccine trial of two cholera vaccines in rural Bangladesh. This analysis reveals the differential protection and waning effects for the vaccines as a function of biotype and age.”

**138 Eslava C, Navarro-Garcia F, Czczulin JR, Henderson IR, Cravioto A, Nataro JP. Pet, an autotransporter enterotoxin from enteroaggregative *Escherichia coli*. Infect Immun 1998 Jul;66(7):3155-63. 64 ref, Eng.** Department of Public Health, Faculty of Medicine, Universidad Nacional Autonoma de Mexico, Ap. Postal 70-443, 04510 Mexico DF, Mexico

**139 Esteban J-G, Aguirre C, Flores A, Strauss W, Angles R, Mas-Coma S. High *Cryptosporidium* prevalences in healthy Aymara children from the northern Bolivian Altiplano. Am J Trop Med Hyg 1998 Jan;58(1):50-5. 50 ref, Eng.** Departamento de Parasitologia, Facultad de Farmacia, Universidad de Valencia, Av. Vicente Andres Estelles s/n, 46100 Burjassot, Valencia, Spain

“The prevalence of *Cryptosporidium* infection was determined in four Aymara communities in the Bolivian Altiplano, between the city of La Paz and Lake Titicaca, at an altitude of 3,800-4,200 meters. Single stool specimens were randomly collected from 377 5-19-year-old students, all apparently asymptomatic. The total prevalence (31.6%) is possibly the highest reported among healthy humans (a maximum of 9.8% and 2.0% in coprologic surveys in underdeveloped and developed countries, respectively) and one of the highest even in symptomatic subjects. No significant age and sex differences were observed. Such an infection prevalence is probably related to the poor sanitation conditions, contaminated water supplies, overcrowding, and close contact with domestic animals. Continuous exposure to the parasite could be associated with protection against parasite-related symptoms in the children examined.”

**140 Farthing MJG. Travellers' diarrhoea: mechanisms, manifestations and management. Medicine 1998;26(8):33-9. 6 ref, Eng.** St. Bartholomew's Hospital, Royal London School of Medicine and Dentistry, Charterhouse square, London EC1 M 6BQ, UK

**141 Faruque SM, Asadulghani, Alim ARMA, Albert MJ, Islam KMN, Mekalanos JJ. Induction of the lysogenic phage encoding cholera toxin in naturally occurring strains of toxigenic *Vibrio cholerae* O1 and O139. Infect Immun 1998 Aug;66(8): 3752-7. 27 ref, Eng.** International Centre for Diarrhoeal Disease Research, Bangladesh, GPO Box 128, Dhaka 1000, Bangladesh

“In toxigenic *Vibrio cholerae*, the CTX genetic element which carries the genes for cholera toxin (CT) is the genome of a lysogenic bacteriophage (CTXF). Clinical and environmental strains of *V. cholerae* O1 or O139 and stools that were culture positive for cholera were analyzed to study the induction and transmission of CTXF. To our knowledge, this is the first report of the examination of CTXF in clinical materials and in naturally occurring strains. DNA probe analysis revealed that 4.25% (6 of 141) of the isolated *V. cholerae* strains spontaneously produced a detectable level of extracellular CTXF particles in the culture supernatants whereas another 34.04% (48 of 141) produced CTXF particles when induced with mitomycin C. CTXF isolated from 10 clinical or environmental strains infected a CT-negative recipient strain, CVD103, both inside the intestines of infant mice and under laboratory conditions. All culture-positive stools analyzed were negative for the presence of CTXF both in the DNA probe assay and by in vivo assay for the infection of the recipient strain in infant mice. These results suggested that naturally occurring strains of toxigenic *V. cholerae* are inducible lysogens of CTXF but that cholera pathogenesis in humans is not associated with the excretion of CTXF particles in stools, indicating that induction of the phage may not occur efficiently inside the human intestine. However, in view of the efficient transmission of the phage under conditions conducive to the expression of toxin-coregulated pili, it appears that propagation of CTXF in the natural habitat may involve both environmental and host factors.”

**1 4 2 Fernandez-Prada C, Tall BD, Elliott SE, Hoover DL, Nataro JP, Venkatesan MM\*. Hemolysin-positive enteroaggregative and cell-detaching *Escherichia coli* strains cause oncosis of human monocyte-derived macrophages and apoptosis of murine J774 cells. Infect Immun 1998 Aug;66(8):3918-24. 45 ref, Eng.** \*Department of Enteric Infections, Bldg. 40, Room B020, Walter Reed Army Institute of Research, Washington, DC 20307-5100, USA

**1 4 3 Fine KD, Ogunji F, George J, Niehaus MD, Guerrant RL. Utility of a rapid fecal latex agglutination test detecting the neutrophil protein, lactoferrin, for diagnosing inflammatory causes of chronic diarrhea. Am J Gastroenterol 1998 Aug;93(8):1300-5. 29 ref, Eng.** Baylor University Medical Center, GI Research, 2<sup>nd</sup> Floor Hoblitzelle, 3500 Gaston Ave., Dallas, TX 75246, USA

**“Objective:** The utility of tests for fecal neutrophils in the setting of chronic diarrhea has not been established. The purpose of this study was to determine the causes of chronic diarrhea associated with fecal neutrophils.

**Methods:** One fecal specimen from each of 10 normal subjects, 26 patients with known microscopic colitis, 13 with celiac sprue, eight with Crohn’s disease, four with ulcerative colitis, and 103 with chronic diarrhea of unknown origin, as well as 10 fecal specimens from a patient with chronic nongranulomatous enterocolitis were analyzed blindly for the presence of a neutrophil granule protein called lactoferrin using a commercial latex agglutination kit. Diagnostic evaluation of the 103 patients with chronic diarrhea was carried out to determine the diagnostic accuracy of this test for chronic inflammatory bowel disease. **Results:** None of the normal control subjects, three of 39 patients with microscopic colitis or celiac sprue, all 10 specimens from the patient with enterocolitis, and all 12 control patients with ulcerative colitis or Crohn’s disease had a positive fecal lactoferrin test. Eleven of 103 patients with chronic diarrhea presenting without a diagnosis had a positive test, and all were diagnosed with an inflammatory condition of the colon (five-, ulcerative colitis; four-, Crohn’s disease; one-, ischemic colitis; and one-, microscopic colitis). Only one patient with inflammatory bowel disease had a negative lactoferrin test. The sensitivity, specificity, and positive and negative predictive values of the fecal lactoferrin test for ulcerative or Crohn’s colitis were 90%, 98%, 82%, and 99%, respectively. **Conclusion:** The major cause of fecal

neutrophils in patients with chronic diarrhea is chronic inflammatory bowel disease of the colon. The latex agglutination test for fecal lactoferrin offers a highly sensitive, specific, and simple means for detection of fecal neutrophils in these patients.”

**1 4 4 Fuchs GJ. Possibilities for zinc in the treatment of acute diarrhea. Am J Clin Nutr 1998 Aug;68(Suppl 2):480-3. 21 ref, Eng.** International Centre for Diarrhoeal Disease Research, Bangladesh, GPO Box 128, Dhaka 1000, Bangladesh

“Zinc therapy shows promise in the treatment of acute diarrhea. Several questions must be answered before it can be incorporated into diarrheal disease control programs, namely, whether it should be targeted at the groups of children in whom it has been shown to work and what the optimal dosing regimen should be, the amount of therapeutic zinc, optimal duration of therapy, and the interaction of zinc and copper absorption. The evidence supporting inclusion of zinc in treatment programs is strong and may become more so when these questions are answered.”

**1 4 5 Gainzarain JC, Canut A, Lozano M, Labora A, Carreras F, Fenoy S, Navajas R, Pieniazek NJ, da Silva AJ, del Aguila C. Detection of *Enterocytozoon bieneusi* in two human immunodeficiency virus-negative patients with chronic diarrhea by polymerase chain reaction in duodenal biopsy specimens and review. Clin Infect Dis 1998 Aug;27(2):394-8. 27 ref, Eng.** Seccion de Microbiologia, Hospital Santiago Apostol, C/Olaguibel 29, 01004 Vitoria (Alava), Spain

“Intestinal microsporidiosis has been associated traditionally with severely immunocompromised patients with AIDS. We describe two new cases of intestinal microsporidiosis due to *Enterocytozoon bieneusi* in human immunodeficiency virus-negative adults. Both patients presented with chronic nonbloody diarrhea, and one had intestinal lymphangiectasia as well. Intestinal microsporidiosis was diagnosed by evaluation of stool samples, and the specific species was determined by use of polymerase chain reaction (PCR) in duodenal biopsy specimens. To our knowledge, this is the first report of confirmation of *E. bieneusi* in the intestinal epithelium of HIV-negative individuals by use of PCR in duodenal biopsy specimens. Cases of intestinal microsporidiosis in HIV-negative individuals reported in the English-language literature are reviewed. These two new cases

along with those described previously corroborate the need to evaluate for microsporidia in HIV-negative individuals with unexplained diarrhea.”

**1 4 6 Gascón J, Vargas M, Quintó L, Corachan M, de Anta MTJ, Vila J. Enteroaggregative *Escherichia coli* strains as a cause of traveler’s diarrhea: a case-control study. *J Infect Dis* 1998 May;177(5):1409-12. 18 ref, Eng. Seccio Medicina Tropical, Hospital Clinic i Provincial de Barcelona, c/Villarroel, 170 08036 Barcelona, Spain**

**1 4 7 Ghosh AR, Sehgal SC. Haemolysin production by environmental isolates of *Vibrio parahaemolyticus* from Andamans. *Indian J Med Res* 1998 Apr;107:151-4. 18 ref, Eng. Regional Medical Research Center, Post Bag no. 13, Port Blair 744101, India**

**1 4 8 Ghosh PK, Gupta S, Leon LR, Ghosh R, Ordaz BHR, Ortiz-Ortiz L. Intestinal amoebiasis: antibody-secreting cells and humoral antibodies. *J Diarrhoeal Dis Res* 1998 Mar;16(1):1-7. 34 ref, Eng. Department of Immunology, Kothari Medical Centre and Research Institute, 8/3 Alipore Road, Calcutta 700027, India**

“Splenic plasma cell response and systemic antibody response to intestinal amoebiasis were studied in C<sub>3</sub>H/HeJ mice from 5 to 60 days post-inoculation with *Entamoeba histolytica*. At various time intervals specific antibody-secreting cells (ASC) in the spleen were measured in infected mice and non-infected control mice by enzyme-linked immunospot (ELISPOT) assay. Serum antibodies were measured by enzyme-linked immunosorbent assay (ELISA). The infected animals showed high IgA ASC from 30 to 50 days post-inoculation as compared to IgM and IgG ASC. However, class-specific serum antibody showed high IgG titre from 30 to 60 days post-inoculation as compared to IgM and IgA serum titres. Our results suggest that *E. histolytica* trophozoites can induce a plasma cell response in the spleen that is different from anti-amoebic antibody response in serum.”

**1 4 9 Goepf JG. Hypocaloric oral therapy during an episode of diarrhea and vomiting can lead to severe malnutrition (editorial). *J Pediatr Gastroenterol Nutr* 1998 Jul;27(1):116-7. 16 ref, Eng. Division of Pediatric Emergency Medicine, University of Rochester School of Medicine, 601 Elmwood Avenue, Box 4-9200, Rochester, NY 14642, USA**

**1 5 0 Grace J. The treatment of infants and young children suffering respiratory tract infection and diarrhoeal disease in a rural community in southeast Indonesia. *Soc Sci Med* 1998 May;46(10): 1291-302. 27 ref, Eng. School of Humanities, Murdoch University, Perth, WA 6150, Australia**

**1 5 1 Gupta P, Murali MV, Seth A. Epidemiology of diarrhea in urban slums. *Indian Pediatr* 1998 Feb;35(2):147-51. 9 ref, Eng. Department of Pediatrics, University College of Medical Sciences and GTB Hospital, Delhi 110095, India**

**1 5 2 Gupta RK, Taylor DN, Bryla DA, Robbins JB, Szu SC. Phase 1 evaluation of *Vibrio cholerae* O1, serotype Inaba, polysaccharide-cholera toxin conjugates in adult volunteers. *Infect Immun* 1998 Jul;66(7):3095-9. 34 ref, Eng. Building 6, Room 424, National Institutes of Health, Bethesda, Maryland 20892, USA**

“Conjugate vaccines were prepared by binding hydrazine-treated lipopolysaccharide (DeALPS) from *Vibrio cholerae* O1, serotype Inaba, to cholera toxin (CT) variants CT-1 and CT-2. Volunteers (n=75) were injected with either 25 mg of DeALPS, alone or as a conjugate, or the licensed cellular vaccine containing 4 x 10<sup>9</sup> organisms each of serotypes Inaba and Ogawa per ml. No serious adverse reactions were observed. DeALPS alone did not elicit serum LPS or vibriocidal antibodies in mice and only low levels of immunoglobulin M (IgM) anti-LPS in the volunteers. Recipients of the cellular vaccine had the highest IgM anti-LPS levels, but the difference was not statistically significant from that elicited by the conjugates. The conjugates elicited the highest levels of IgG anti-LPS (DeALPS-CT-2 > DeALPS-CT-1 > cellular vaccine). Both conjugates and the cellular vaccine elicited vibriocidal antibodies: after 8 months, recipients of cellular vaccine had the highest geometric mean titer (1,249), followed by DeALPS-CT-2 (588) and DeALPS-CT-1 (330). The correlation coefficient between IgG anti-LPS and 2-mercaptoethanol (2-ME)-resistant vibriocidal antibodies was 0.81 (p=0.0004). Convalescent sera from cholera patients had a mean vibriocidal titer of 2,525 that was removed by treatment with 2-ME. The vibriocidal activities of sera from all vaccine groups and from the patients were absorbed (>75%) by LPS but not by either CT-1 or CT-2. Conjugate-induced IgG vibriocidal antibodies persisted longer than those elicited by the whole-cell

vaccine. Both conjugates, but not the cellular vaccine, elicited IgG anti-CT.”

**1 5 3 Gupta S, Ghosh P, Naik S, Naik SR. Proteinase activity & virulence of *Entamoeba histolytica* on passage through hamster liver. *Indian J Med Res* 1998 Apr;107:173-7. 23 ref, Eng.** Department of Gastroenterology, Sanjay Gandhi Postgraduate Institute of Medical Sciences, Raebareli road, Lucknow 226014, India

**1 5 4 Guscetti F, Bernasconi C, Tobler K, Reeth KV, Pospischil A, Ackermann M. Immunohistochemical detection of porcine epidemic diarrhea virus compared to other methods (note). *Clin Diagn Lab Immunol* 1998 May;5(3):412-4. 13 ref, Eng.** Institut fuer Veterinaer-pathologie der Universitaet Zuerich, Winterthurerstr. 268, CH-8057 Zuerich, Switzerland

**1 5 5 Gustafsson A, Lund-Tønnesen S, Berstad A, Midtvedt T, Norin E. Faecal short-chain fatty acids in patients with antibiotic-associated diarrhoea, before and after faecal enema treatment. *Scand J Gastroenterol* 1998 Jul;33(7):721-7. 31 ref, Eng.** Laboratory of Medical Microbial Ecology, Department of Cell and Molecular Biology, Karolinska Institute, Doktorsringen 4A, S-171 77 Stockholm, Sweden

“**Background:** Antibiotic-associated diarrhoea (AAD) may range from mild disturbances to severe pseudomembranous colitis. Many antibiotics affect several intestinal microflora-associated characteristics, such as short-chain fatty acid (SCFA) pattern. In the present study we investigated SCFAs in 31 patients on admittance to the hospital for severe AAD. Nine patients were followed up more extensively after they had received an enema containing faecal microflora from a healthy person on a Western diet. **Methods:** Faecal SCFAs were determined by gas chromatography. The enema was characterized before use. **Results:** AAD patients showed significant disturbances in faecal SCFA pattern. Clinically, most enema-treated patients recovered within days and had no relapses within 18 months. **Conclusions:** Intestinal microflora showed great disturbances, and the amounts of SCFAs were reduced, although the diarrhoea was not related to total amount SCFAs. Administration of a faecal enema resulted in the clinical recovery of most patients with severe diarrhoea within 4 days.”

**156 Hossain S, Biswas R, Kabir I, Sarker S, Dibley M, Fuchs G, Mahalanabis D. Single dose vitamin A**

**treatment in acute shigellosis in Bangladeshi children: randomised double blind controlled trial. *Br Med J* 1998 Feb 7;316(7129):422-6. 46 ref, Eng.** International Centre for Diarrhoeal Disease Research, Bangladesh, GPO Box 128, Dhaka 1000, Bangladesh

“**Objective:** To evaluate the efficacy of a single large oral dose of vitamin A in treating acute shigellosis in children in Bangladesh. **Design:** Randomised double blind controlled clinical trial. **Setting:** Dhaka Hospital, International Centre for Diarrhoeal Disease Research, Bangladesh. **Subjects:** 83 children aged 1-7 years with bacteriologically proved shigellosis but no clinical signs of vitamin A deficiency; 42 were randomised to treatment with vitamin A and 41 formed a control group. **Intervention:** Children were given a single oral dose of 200 000 IU of vitamin A plus 25 IU vitamin E or a control preparation of 25 IU vitamin E. **Main outcome measures:** Clinical cure on study day 5 and bacteriological cure. **Results:** Baseline characteristics of the subjects in the two treatment groups were similar. Significantly more children in the vitamin A group than in the control group achieved clinical cure (19/42 (45%) v 8/41 (20%);  $\chi^2=5.14$ , 1 df,  $P=0.02$ ; risk ratio =0.68 (95% confidence interval: 0.50 to 0.93). When cure was determined bacteriologically, the groups had similar rates (16/42 (38%) v 16/41 (39%);  $\chi^2=0.02$ , 1 df,  $P=0.89$ ; risk ratio=0.98 (0.70 to 1.39). **Conclusions:** Vitamin A reduces the severity of acute shigellosis in children living in areas where vitamin A deficiency is a major public health problem.”

**157 Houang ETS, Chu Y-W, Ng T-K, Cheng AFB. Study of the relatedness of isolates of *Shigella flexneri* and *Shigella sonnei* obtained in 1986 and 1987 and in 1994 and 1995 from Hong Kong. *J Clin Microbiol* 1998 Sep;36(9):2404-7. 21 ref, Eng.** Department of Microbiology, Chinese University of Hong Kong, Prince of Wales Hospital, Shatin N.T., Hong Kong

“We used pulsed-field gel electrophoresis (PFGE) to study the genetic relatedness of 235 isolates of *Shigella flexneri* and *Shigella sonnei* collected in Hong Kong (97 isolates from 1986 and 1987 and 138 isolates from 1994 and 1995). Altogether, 13 gels were run with bacteriophage lambda ladder DNA (Pharmacia) as an external reference in every sixth lane, standardized reagents and methods, and isolates randomized for species and years. For quantitative illustration of the relationships within a large body of isolates, computer-generated dendrograms were used to determine the

number of isolates in pulsotypes at Dice coefficients of similarity of 75% (PT<sub>75</sub>) and 50% (PT<sub>50</sub>). For *S. flexneri*, there was a significant difference in the distribution of isolates collected during the two periods in both PT<sub>75</sub> and PT<sub>50</sub>, with 68% of isolates collected in 1994 and 1995 sharing a coefficient of similarity of <sup>3</sup> 68%. For *S. sonnei*, a significant difference was observed in PT<sub>50</sub> only. We also used Upholt's formula for an approximation of the fraction of nucleotide difference between isolates and Molecular Evolutionary Genetics Analysis to determine relative genetic distances. For both species, the relative genetic distances between isolates of the earlier collection period were significantly greater ( $P < 0.0001$ ), i.e., they were further apart and therefore more diverse than those of the later period. We conclude that it is possible for a typical clinical laboratory to analyze a large amount of PFGE information on *Shigella* isolates obtained under controlled conditions. Such data analysis should enhance surveillance capabilities and give indications of further work to be done on various aspects of bacterial pathogenicity of the species."

**1 5 8 Hussain MA, Rahman KM, Haq JA, Ashna SMZH. Studies on the *Campylobacter jejuni* isolated from diarrhoeal children. J Chittagong Med Coll Teachers' Assoc 1996 Jun;7(1):7-16. 37 ref, Eng. Chittagong Medical College, Chittagong, Bangladesh**

**1 5 9 Ijaz MK, Nur-E-Kamal MSA, Dar FK, Uduman S, Redmond MJ, Attah-Poku SK, Dent D, Babiuk LA. Inhibition of rotavirus infection *in vitro* and *in vivo* by a synthetic peptide from VP4. Vaccine 1998 May/Jun;16(9/10):916-20. 28 ref, Eng. Department of Medical Microbiology, Faculty of Medicine and Health Sciences, United Arab Emirates University, PO Box 17666, Al-Ain, United Arab Emirates**

"A synthetic peptide corresponding to bovine rotavirus C486 (BRV) VP4 amino acid sequence 232-255 (VP4-peptide) was studied with the objective of defining the origin of the protective immune response reported previously by Ijaz *et al.* (J. Virol. 1991, 65, 3106-3113). Pretreatment of MA-104 cells with the VP4-peptide before infection with rotavirus prevented both the attachment of <sup>35</sup>S-labelled virus and plaque formation *in vitro*. *In vivo* studies using a murine rotavirus model demonstrated that intragastric administration of VP4-peptide protected subjects from challenge with virulent rotavirus. These results clearly indicate the importance

of this epitope in virus-cell interactions and their potential as a rotavirus vaccine candidate."

**1 6 0 Islam S, Faruque ASG, Fuchs GJ, Wahed MA, Mahalanabis D. Shelf-life of pre-cooked rice oral rehydration salt packets. Southeast Asian J Trop Med Public Health 1997 Dec;28(4):862-4. 3 ref, Eng. International Centre for Diarrhoeal Disease Research, Bangladesh, GPO Box 128, Dhaka 1000, Bangladesh**

"The shelf-life of pre-cooked rice oral rehydration salts (ORS) at the household level was studied in urban Dhaka. To prepare the packets, cooked rice was dried and ground to fine powder and the salt ingredients were mixed according to the World Health Organization formulation. For each half liter packet, 10 g glucose was replaced by 25 g of instant cooked rice powder. The packets were kept in different environments for three months among 30 households of varying socioeconomic status. At monthly intervals, two packets from each family were collected for laboratory tests. Physical characteristics of ORS such as color and dispersibility remained the same throughout the three month study period. However, in the third month flavor changed slightly. The electrolyte concentration of the prepared solution remained the same at the end of the first, second and third months. However, progressive but minimal increase in moisture content of the packets was noted over the allotted time period. This increase in moisture was less when the mixture was packed in double thin layer polythene bags as opposed to the single layer bags. In conclusion, the shelf-life of pre-cooked rice ORS remains stable at least up to three months when stored at the household level. Therefore, pre-cooked rice ORS can be kept at households for future use in the event of diarrheal episodes."

**1 6 1 Jackson CJ, Fox AJ, Jones DM, Wareing DRA, Hutchinson DN. Associations between heat-stable (O) and heat-labile (HL) serogroup antigens of *Campylobacter jejuni*: evidence for interstrain relationships within three O/HL serovars. J Clin Microbiol 1998 Aug;36(8):2223-8. 42 ref, Eng. PHLS Mycology Reference Laboratory, Department of Microbiology, University of Leeds, Leeds LS2 9JT, England, UK**

"A comparative examination of the heat-stable (O) and heat-labile (HL) serogrouping results for 9,024 sporadic human isolates of *Campylobacter jejuni* revealed conserved associations between specific O and HL antigens (O/HL serovars). Forty-nine percent of the



isolates which grouped for both O and HL antigens belonged to one of three serovars: O 4 complex/HL 1 (17.9%), O 1/HL 2 (16.8%), or O 50/HL 7 (14.5%). Other common serovars were O 2/HL 4 (8.3%), O 6/HL 6 (8.1%), O 53/HL 11 (4.5%), O 19/HL 17 (3.3%), O 5/HL 9 (3.3%), O 9/HL 9 (3.2%), and O 23/HL 5 (3.1%). These 10 serovars accounted for 83.1% of the serogroupable isolates. A large number of strains (41.3%) could be typed by only one of the two methods or could not be serogrouped (11%). Strains belonging to three serovars, O 2/HL 4, O 50/HL 7, and O 23/HL 5, were further characterized by combining data from expressed features (O/HL serogroups, phage groups, and biotypes) with restriction fragment length polymorphism genotypes. These polyphasic data demonstrated that within each serovar, individual isolates should show substantial conservation of both genomic and phenotypic characteristics. The essentially clonal nature of the three serovars confirmed the potential of combined O and HL serogrouping as a practical and phylogenetically valid method for investigating the epidemiology of sporadic *C. jejuni* infection."

**1 6 2 Joe A, Verdon R, Tzipori S, Keusch GT, Ward HD. Attachment of *Cryptosporidium parvum* sporozoites to human intestinal epithelial cells. *Infect Immun* 1998 Jul;66(7):3429-32. 29 ref, Eng.** Division of Geographic Medicine and Infectious Diseases, New England Medical Center, Tufts University School of Medicine, 750 Washington St., New England Medical Center Box 041, Boston, MA 02111, USA

"An enzyme-linked immunosorbent assay-based attachment model using the human intestinal cell line Caco-2A was developed to study attachment of *Cryptosporidium parvum* sporozoites in vitro and to assess potential inhibitors of sporozoite binding. In this system, attachment was related to sporozoite dose, incubation time, and host cell differentiation status. Polyclonal antibodies to *C. parvum* as well as glycoprotein inhibitors of a sporozoite lectin reduced attachment. This model will be a valuable tool in elucidating specific molecules and mechanisms involved in sporozoite-host cell attachment."

**1 6 3 Johnson S, Gerding DN. *Clostridium difficile*-associated diarrhea. *Clin Infect Dis* 1998 May; 26(5):1027-36. 38 ref, Eng.** Medical Service, VA Chicago Health Care System, Lakeside Division, 333 East Huron, Chicago, Illinois 60611, USA

**1 6 4 Jouravleva EA, McDonald GA, Marsh JW, Taylor RK, Boesman-Finkelstein M, Finkelstein RA. The *Vibrio cholerae* mannose-sensitive hemagglutinin is the receptor for a filamentous bacteriophage from *V. cholerae* O139. *Infect Immun* 1998 Jun;66(6): 2535-9. 31 ref, Eng.** Department of Molecular Microbiology and Immunology, School of Medicine, DC 385.00, Allton Building 208, University of Missouri - Columbia, 301 Business Loop 70 West, Columbia, MO 65212, USA

**1 6 5 Kadurugamuwa JL, Beveridge TJ. Delivery of the non-membrane-permeative antibiotic gentamicin into mammalian cells by using *Shigella flexneri* membrane vesicles. *Antimicrob Agents Chemother* 1998 Jun; 42(6):1476-83. 35 ref, Eng.** Research and Development, Roche Vitamins Inc., Building 102, 340 Kingsland Street, Nutley, NJ 07110-1199, USA

"We developed a model to test whether non-membrane-permeative therapeutic agents such as gentamicin could be delivered into mammalian cells by means of bacterial membrane vesicles. Many gram-negative bacteria bleb off membrane vesicles (MVs) during normal growth, and the quantity of these vesicles can be increased by brief exposure to gentamicin (J.L. Kadurugamuwa and T.J. Beveridge, *J. Bacteriol.* 177:3998-4008, 1995), which can be entrapped within the MVs. Gentamicin-induced MVs (g-MVs) were isolated from *Shigella flexneri* and contained  $85 \pm 2$  ng of gentamicin per mg of MV protein. Immunogold electron microscopic labeling of thin sections with antibodies specific to *S. flexneri* lipopolysaccharide (LPS) demonstrated the adherence and subsequent engulfment of MVs by the human Henle 407 intestinal epithelial cell line. Further incubation of g-MVs with *S. flexneri*-infected Henle cells revealed that the g-MVs penetrated throughout the infected cells and reduced the intracellular pathogen by  $\sim 1.5 \log_{10}$  CFU in the first hour of incubation. Antibiotic was detected in the cytoplasm of host cells, indicating the intracellular placement of the drug following the penetration of g-MVs. Soluble antibiotic, added as a fluid to the tissue culture growth medium, had no effect on intracellular bacterial growth, confirming the impermeability of the cell membranes of the tissue to gentamicin. Western blot analysis of MVs with *S. flexneri* Ipa-specific antibodies demonstrated that the invasion protein antigens IpaB, IpaC, and IpaD were present in MVs. Being bilayered, with outer faeces composed of LPS and Ipa proteins,

these MVs were readily engulfed by the otherwise impermeable membranes and eventually liberated their contents into the cytoplasmic substance of the host tissue.”

**1 6 6 Khalil K, Khan SR, Mazhar K, Kaijser B, Lindblom G-B. Occurrence and susceptibility to antibiotics of *Shigella* species in stools of hospitalized children with bloody diarrhea in Pakistan. Am J Trop Med Hyg 1998 Jun;58(6): 800-3. 31 ref, Eng.** Department of Clinical Bacteriology, Göteborg University, Guldhedsgatan 10 A, S-413 46, Göteborg, Sweden

“The aim of the present investigation was to study the frequency of *Shigella* spp. in patients with bloody diarrhea in Pakistan and the susceptibility of isolated *Shigella* to three antibiotics: ampicillin, cotrimoxazole and nalidixic acid. In addition, the frequency of *Campylobacter* and *Salmonella* was also determined. Stool samples (n = 152) were collected from 152 diarrheic children less than six years of age passing blood and mucus in their stools who were admitted to Paediatric Department of Mayo Hospital in Lahore, Pakistan from June to September 1990. The samples were cultivated on standard media for *Shigella*, *Campylobacter*, and *Salmonella*. Susceptibility of *Shigella* isolates was tested by disk diffusion method. The frequency of isolation was 19.1% for *Shigella* spp., 7.9% for *Campylobacter*, and 4.6% for *Salmonella*. *Shigella flexneri* (7.9%) was the most frequently isolated species, followed by *S. dysenteriae* (6.6%), *S. boydii*, (3.3%) and *S. sonnei* (1.3%). All *Shigella* isolates were susceptible to nalidixic acid (100%), while only a few were susceptible to cotrimoxazole (7.0%) and ampicillin (3.5%). In Pakistan, self-medication and purchases of drugs without a prescription are commonly practiced. Thus, there is a greater possibility of development of resistant strains due to over use of antibiotics.”

**1 6 7 Lai V, Wang L, Reeves PR. *Escherichia coli* clone sonnei (*Shigella sonnei*) had a chromosomal O-antigen gene cluster prior to gaining its current plasmid-borne O-antigen genes (note). J Bacteriol 1998 Jun;180(11):2983-6. 30 ref, Eng.** Department of Microbiology, University of Sydney, Sydney, N.S.W. 2006, Australia

**1 6 8 Lee SH, Angelichio MJ, Mekalanos JJ, Camilli A. Nucleotide sequence and spatiotemporal expression of the *Vibrio cholerae* *vieSAB* genes during**

**infection. J Bacteriol 1998 May;180(9):2298-305. 26 ref, Eng.** Department of Molecular Biology & Microbiology, Tufts University School of Medicine, 136 Harrison Ave., Boston, MA 02111, USA

“The *iviVII* gene of *Vibrio cholerae* was previously identified by a screen for genes induced during intestinal infection. In the present study, nucleotide sequence analysis revealed that *iviVII* is a 1,659-bp open reading frame, herein designated *vieB*, that is predicted to be last in a tricistronic operon (*vieSAB*). The deduced amino acid sequence of VieS exhibited similarity to the sensor kinase component, and those of VieA and VieB were similar to the response regulator components, respectively, of the two-component signal transduction family. Analysis of transcriptional fusions to a site-specific DNA recombinase reporter, *tnpR*, revealed that *vieS* and *vieA* are transcribed during in vitro growth in a *vieAB*-independent and *vieA*-dependent manner, respectively. In contrast, transcription of *vieB* occurred exclusively during infection and was not dependent upon VieB. We conclude that the *vieSAB* genes are differentially regulated, at least during laboratory growth. Use of a *V. cholerae* strain harboring a *vieB:tnpR* transcriptional fusion allowed the kinetics and location of *vieB* expression within the intestine to be determined. We found that *vieB* transcription is induced shortly after infection of the proximal and mid-small intestine.”

**1 6 9 Lee WS, Puthuchery SD, Boey CCM. Non-typhoid *Salmonella* gastroenteritis. J Paediatr Child Health 1998 Aug;34(4):387-90. 22 ref, Eng.** Department of Paediatrics, University of Malaya Medical Centre, 50603 Kuala Lumpur, Malaysia

“**Objective:** To study the clinical features of non-typhoid *Salmonella* gastroenteritis and the incidence, risk factors and outcome of invasive complications in urban Malaysian children. To describe the serotypes of *Salmonella* species isolated and the pattern of antibiotic susceptibility. **Methodology:** Retrospective review of a group of 131 children with non-typhoid *Salmonella* gastroenteritis seen at the University Hospital, Kuala Lumpur, Malaysia from January 1994 to December 1996. **Results:** Sixty-seven percent were infants below one year of age. Fever and vomiting were seen in nearly half of children. Seven children (5.3%) had invasive complications: 5 bacteraemia and 2 meningitis. Age below 6 months, fever >38.0° C, and dehydration on admission were significantly associated with invasive complications. The commonest serotypes isolated were

*S. enteritidis*, *S. paratyphi B*, and *S. bovis-morbificans*. A total of 94-100% of isolates were susceptible to commonly prescribed antibiotics. **Conclusions:** Children with *Salmonella* gastroenteritis below 6 months of age who are febrile and dehydrated should be treated empirically with antibiotics until the result of blood culture is available."

**1 7 0 Lira PIC, Ashworth A, Morris SS. Effect of zinc supplementation on the morbidity, immune function, and growth of low-birth-weight, full-term infants in northeast Brazil. Am J Clin Nutr 1998 Aug;68(Suppl 2):418-24. 26 ref, Eng.** Center for Human Nutrition, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK

"In Brazil, the highest incidence of low birth weight (LBW) occurs in the northeast, and diarrhea and respiratory infections are the main causes of infant mortality and morbidity. We hypothesized that LBW infants may be zinc deficient, and that this might be adversely affecting their immune function, morbidity, and postnatal growth. We therefore examined the effect of zinc supplementation on these outcomes during the first 6 mo of life. LBW full-term infants (mean birth weight 2337 g) were given daily for 8 wk either 5 mg Zn (n=71, 1 mg Zn (n=68, or a placebo (n=66). Morbidity was determined prospectively through daily home visits (except on Sunday) during weeks 0-8, then twice weekly in weeks 9-26. Anthropometric measurements were made at 0, 4, 8, 17, and 26 wk. Immune function was assessed at 8 wk by the phytohemagglutinin skin test. Supplementation (5 mg Zn) was associated with a 28% reduction in diarrhea prevalence over the 6-mo period [after adjustment for confounders (p=0.043)], and a 33% reduction in the prevalence of cough (NS, adjusted prevalence (p=0.073). All infants had a positive immune response at 8 wk. Although supplementation had no significant effect on weight and length gains from 0 to 26 wk, infants given 5 mg Zn gained more weight than infants given placebo during weeks 17-26 (p=0.024, analysis of variance). There was no effect on any outcome with 1 mg Zn. We conclude that 5 mg Zn/d is of benefit to LBW, full-term infants who only have a modest weight deficit."

**1 7 1 Ludmerer KM, Kissane JM. Diarrhea with ileal and hepatic abnormalities in a 52-year-old man. Am J Med 1998 Apr;104(4): 398-403. 23 ref, Eng.** Department of Internal Medicine, Washington University

School of Medicine, Box 8051, 660 S. Euclid Ave., St. Louis, MO 63110, USA

**1 7 2 Mascarenhas JDP, Paiva FL, Barardi CRM, Gabbay YB, Simoes CO, Linhares AC\*. Rotavirus G and P types in children from Belem, northern Brazil, as determined by RT-PCR: occurrence of mixed P type infections. J Diarrhoeal Dis Res 1998 Mar;16(1):8-14. 36 ref, Eng.** Instituto Evandro Chagas, Fundacao Nacional de Saude, CEP 66090-000, Belem, Para, Brasil

"Fifty-four group A rotavirus-positive stool samples, obtained from children aged less than three years during a longitudinal (December 1982 to March 1986) study in Belém, Brazil, were re-examined. The samples were tested by reverse-transcription and polymerase chain reaction to determine their G-type and P-type specificity. Only 17 (32%) of these rotavirus strains could be successfully G- and P-genotyped. While 10 (59%) of the 17 strains showed single G- and P-type specificity, the remaining belonged to single G- and mixed P-genotypes. Rotavirus strains P[8],G1 and P[4],G1 predominated, accounting for 29% and 18% of the typed strains respectively. Mixed P-type infections caused by rotaviruses classified as P[8]+P[4], G1 were identified in 23% of cases. All but 3 of the 54 rotavirus strains displayed long genomic profiles, as demonstrated by the analysis of RNA by polyacrylamide gel electrophoresis. Most (70%) rotavirus strains with single G- and P-type specificity were detected during the first year of life, whereas 5 (71%) of the seven mixed P-type infections occurred throughout the second or third year of age. Reinfections were noted in two children, both of them being infected with P[8]+P[4], G1 rotavirus strains when aged 20 months. The high proportion of untypeable rotavirus strains suggests that unusual types may be circulating in Belém. In addition, the occurrence of mixed P-type infections in our region indicates the potential for reassortment between different rotavirus genogroups. Monitoring of these rotavirus strains may have important implication in the context of future strategies of rotavirus vaccination in Brazil."

**1 7 3 Mason HS, Haq TA, Clements JD, Arntzen CJ. Edible vaccine protects mice against *Escherichia coli* heat-labile enterotoxin (LT): potatoes expressing a synthetic LT-B gene. Vaccine 1998 Aug;16(13): 1336-43. 20 ref, Eng.** Boyce Thompson Institute for Plant Research, Tower Road, Ithaca, NY 14853-1801, USA

“The authors have designed and constructed a plant-optimized synthetic gene encoding the *Escherichia coli* heat-labile enterotoxin B subunit (LT-B), for use in transgenic plants as an edible vaccine against enterotoxigenic *E. coli*. Expression of the synthetic LT-B gene in potato plants under the control of a constitutive promoter yielded increased accumulation of LT-B in leaves and tubers, as compared to the bacterial LT-B gene. The plant-derived LT-B assembled into native pentameric structures as evidenced by its ability to bind ganglioside. The authors demonstrated immunogenicity by feeding mice the raw tubers and comparing the anti-LT-B serum IgG and faecal IgA to that produced in mice gavaged with bacterial LT-B. Mice were fed three weekly doses of 5 mg tuber tissue containing either 20 or 50 mg LT-B, or gavaged weekly with 5 mg of LT-B from recombinant *E. coli*. One week after the third dose, mice immunized with potato LT-B had higher levels of serum and mucosal anti-LT-B than those gavaged with bacterial LT-B. Mice were challenged by oral administration of 25 mg LT, and protection assessed by comparing the gut/carcass mass ratios. Although none of the mice were completely protected, the higher dose potato vaccine compared favourably with the bacterial vaccine. These findings show that an edible vaccine against *E. coli* LT-B is feasible.”

**174 Mathan VI. Diarrhoeal Diseases. Br Med Bull 1998;54(2):407-19. 38 ref, Eng.** International Centre for Diarrhoeal Disease Research, Bangladesh, GPO Box 128, Dhaka 1000, Bangladesh

“Diarrhoea is a symptom of the response of the intestinal tract to a variety of primary diseases. It can be clinically classified based on the duration of the symptom and other associated features. In tropical regions, acute infective diarrhoea is widely prevalent and is an important factor contributing to morbidity and mortality, especially in children. The strategy of maintaining hydration by oral rehydration solutions has contributed significantly to reduction of mortality. Antibiotics are indicated only under specified circumstances. Persistent diarrhoea with prolonged symptoms increases the morbidity and mortality. Chronic diarrhoea is often associated with malabsorption of nutrients and an important component is tropical sprue, a primary malabsorption syndrome. Since diarrhoea is the response of the host to a variety of factors, the detailed study of this symptom has furthered the understanding of intestinal physiology.”

**175 Matsumoto M, Suzuki Y, Saito M, Ishikawa N, Ohta M. Epidemiologic study of *Shigella sonnei* from sequential outbreaks and sporadic cases using different typing techniques. Microbiol Immunol 1998;42(4):259-64. 22 ref, Eng.** Department of Bacteriology, Aichi Prefectural Institute of Public Health, 7-6 Nagare, Tsuji-machi, Kita-ku, Nagoya, Aichi 462-8576, Japan

**176 Mattsson A, Lönroth H, Quiding-Järbrink M, Svennerholm A-M. Induction of B cell responses in the stomach of *Helicobacter pylori*-infected subjects after oral cholera vaccination. J Clin Invest 1998 Jul 1;102(1):51-6. 38 ref, Eng.** Department of Medical Microbiology, Göteborg University, S-413 46 Göteborg, Sweden

“We have evaluated the possibility of inducing antibody responses locally in the human stomach as a prerequisite for the development of a vaccine against *Helicobacter pylori*. Both *H. pylori*-infected and noninfected subjects were immunized with an oral B subunit whole cell (BS-WC) cholera vaccine, and total and vaccine-specific antibody-secreting cells (ASC) were determined by the enzyme-linked immunospot (ELISPOT) technique in cells isolated from the antrum and duodenum, respectively, before and after vaccination. Most of the subjects responded to the vaccination with high frequencies of vaccine-specific ASCs in the duodenum as well as high-serum antibody titers, and no significant differences were seen in the responses between *H. pylori*-infected and noninfected subjects. When studying the gastric mucosa, on the other hand, there were dramatic differences between the *H. pylori*-infected and the noninfected subjects. Thus, whereas none of the noninfected subjects responded to the immunization in antrum, most of the *H. pylori*-infected subjects had high frequencies of vaccine-specific ASCs in this location after vaccination. Furthermore, the *H. pylori*-infected subjects had strikingly higher (as a mean 80-fold) frequencies of total IgA-secreting cells in antrum than the noninfected subjects, whereas the frequencies of total IgA-secreting cells in the duodenum were comparable between the groups. In conclusion, these results demonstrate the possibility of inducing antibody responses locally in the gastric mucosa of *H. pylori*-infected individuals, a finding with obvious implications for the future development of a therapeutic vaccine against *H. pylori*.”

**177 Menchaca G, Padilla-Noriega L, Mendez-Toss M, Contreras JF, Puerto FI, Guiscafne H, Mota F, Herrera I, Cedillo R, Munoz O, Ward R, Hoshino Y, Lopez S, Arias CF. Serotype specificity of the neutralizing-antibody response induced by the individual surface proteins of rotavirus in natural infections of young children. Clin Diagn Lab Immunol 1998 May;5(3):328-34. 65 ref, Eng.** Departamento de Biología Molecular, Instituto de Investigaciones Biomedicas, Universidad Nacional Autonoma de Mexico, Mexico City 04510, Mexico

“The relative contribution of the rotavirus surface proteins, VP4 and VP7, to the induction of homotypic as well as heterotypic neutralizing antibodies (NtAbs) in natural infections was studied. The NtAb titers of paired sera from 70 infants with serologically defined primary rotavirus infections were determined with a panel of rotavirus reassortants having one surface protein from a human rotavirus (serotypes G1 to G4 for VP7 and P1A and P1B for VP4) and the other surface protein from a heterologous animal rotavirus strain. A subset of 37 children were evaluated for epitope-specific antibodies to the two proteins by an epitope-blocking assay. The infants were found to seroconvert more frequently to VP4 than to VP7 by both methods, although the titers of the seroconverters were higher to VP7 than to VP4. Both proteins induced homotypic as well as heterotypic NtAbs. G1 VP7 frequently induced a response to both G1 and G3 VP7s, while G3 VP7 and P1A VP4 induced mostly homotypic responses.”

**178 Minh NB, Lanata CF, Black RE, Gil AI, Karnell A, Wretling B\*. Age-related prevalence of Shigella and Salmonella antibodies and their association with diarrhoeal diseases in Peruvian children. Scand J Infect Dis 1998;30(2):159-64. 32 ref, Eng.** \*Division of Clinical and Oral Bacteriology, Huddinge University Hospital F82, S-14186 Huddinge, Sweden

“*Shigella* and *Salmonella* antibodies in relation to diarrhoea were studied in a cohort of 413 children between 2 and 27 months of age in peri-urban Lima, Peru. Blood samples were obtained at 2, 3 and 12 months of age. Antibody titres against lipopolysaccharide from *Shigella flexneri* serotype Y, *Shigella dysenteriae* serotype 1, *Shigella sonnei*, *Salmonella* serogroups AO, BO, DO, and *Shigella* Ipa and *Salmonella typhi* Vi antigens were measured by enzyme immunoassay. IgG titres against *S. flexneri* and *Shigella* Ipa were

higher at 2 than at 3 or 12 months of age ( $P=0.001$ ), while the changes in IgG titres against *S. dysenteriae*, *S. sonnei* and *Salmonella* were not pronounced. IgA and IgM titres against *S. flexneri*, *Shigella* Ipa, *S. dysenteriae*, *S. sonnei* and *Salmonella* were significantly higher at 12 than at 2 or 3 months of age ( $p=0.001$ ). Stool samples were obtained from children in 64% of all diarrhoeal episodes. *Shigella* spp. were isolated from 20% of the children during the first 2 y of life and *Salmonella* in 3%. Most isolates were from children at 13-24 months of age (78%). IgG antibodies at 12 months of age did not protect against shigellosis during the second year of life.”

**179 Moghal NE, Ferreira MAS, Howie AJ, Milford DV\*, Raafat F, Taylor CM. The late histologic findings in diarrhea-associated hemolytic uremic syndrome. J Pediatr 1998 Aug;133(2):220-3. 20 ref, Eng.** \*Department of Nephrology, Birmingham Children's Hospital, Steelhouse Lane, Birmingham B4 6N4, UK

“Kidney biopsies were undertaken for persisting proteinuria 3.3 to 7 years (mean 5.4 years) from the onset of diarrhea-associated hemolytic uremic syndrome (D+HUS) in 5 boys and 2 girls (age at presentation mean 3.2 years, range 1.0 to 9.7 years). At 1 year the mean early morning urine protein/creatinine ratio was 100 mg/mmol, and the mean glomerular filtration rate was 65 mL/min/1.73 m<sup>2</sup>. At 5 years the mean early morning urine protein/creatinine ratio was 81 mg/mmol, and the mean glomerular filtration rate was 73 mL/min/1.73m<sup>2</sup>. The biopsy specimens were compared with those of 7 age- and sex-matched children who were investigated for isolated persistent microscopic hematuria but in whom no abnormality was detected. Global glomerulosclerosis was noted in 6 patients with D+HUS, and 2 of these had segmental sclerosing lesions. Tubular atrophy and interstitial scarring were seen in all but 1 patient. The glomeruli in the D+HUS group were significantly larger than in the control group ( $P<.01$ ). These findings are typically found in kidneys with reduced nephron numbers and are compatible with changes of hyperperfusion and hyperfiltration in surviving nephrons. Long-term follow-up of patients with D+HUS and proteinuria is advisable.”

**180 Moolasart P, Eampokalap B, Supaswadikul S. Comparison of the efficacy of tetracycline and norfloxacin in the treatment of acute severe watery**

**diarrhea. Southeast Asian J Trop Med Public Health 1998 Mar;29(1):108-11. 20 ref, Eng.** Bamrasnaradura Infectious Disease Hospital, 126 Tiwanon Road, Nonthaburi 110000, Thailand

“Antibiotic treatment appears to shorten the duration of diarrhea and eradicate *Vibrio cholerae*. The objective of this study was to compare the efficacy of tetracycline with norfloxacin therapy in patients (adults and children) with acute severe diarrhea caused by VC01 and VC0139. Patients (adults and children) with acute severe watery diarrhea admitted to Bamrasnaradura Infectious Disease Hospital, Thailand were randomized to receive either tetracycline (500 mg qid in adults and 12.5 mg/kg qid in children) or norfloxacin (400 mg bid in adults and 7.5 mg/kg bid in children) for 3 days each. The duration of diarrhea and the fecal shedding were comparable between two groups. Thirteen cases were treated with tetracycline and twelve cases with norfloxacin. The results showed the mean duration of diarrhea in tetracycline-treated and norfloxacin-treated groups were 1.31 and 1.25 days, respectively. The mean fecal shedding in tetracycline-treated and norfloxacin-treated group were 1.38 and 1.33 days, respectively. However, there were no statistically significant differences between two groups of both comparisons ( $p > 0.05$ ). All isolates (VC 01 and VC 0139) in this study were susceptible to both antibiotics. Tetracycline therapy is as good as norfloxacin therapy for quick recovery and time for bacterial eradication in patients with acute severe watery diarrhea caused by *Vibrio cholerae*. Children aged less than 8 years should not use tetracycline therapy because of its toxic effects.”

**1 8 1 Morita Y, Kodama K, Shiota S, Mine T, Kataoka A, Mizushima T, Tsuchiya T. NorM, a putative multidrug efflux protein, of *Vibrio parahaemolyticus* and its homolog in *Escherichia coli*. Antimicrob Agents Chemother 1998 Jul;42(7):1778-82. 34 ref, Eng.** Department of Microbiology, Faculty of Pharmaceutical Sciences, Okayama University, Tsushima, Okayama 700-8530, Japan

**1 8 2 Moss DM, Bennett SN, Arrowood MJ, Wahlquist SP, Lammie PJ. Enzyme-linked immunoelectrotransfer blot analysis of a cryptosporidiosis outbreak on a United States Coast Guard cutter. Am J Trop Med Hyg 1998 Jan;58(1):110-8. 44 ref, Eng.** Division of Parasitic Diseases, National Center for Infectious Diseases,

Centers for Disease Control and Prevention, Mailstop F-13, 4770 Buford Highway, Chamblee, GA 30341, USA

“Symptoms consistent with an outbreak of cryptosporidiosis (diarrhea, vomiting, nausea, and abdominal cramps) occurred on a U.S. Coast Guard cutter within 0-18 days after the cutter filled its tanks with Milwaukee, Wisconsin city water in March 1993. At three-weeks postdocking (PD), the suspected water was removed, and serum samples and stool specimens were collected from 47 of the 58 crew members, as well as questionnaire data on their water consumption and symptoms aboard the cutter. At 10-weeks PD and/or at 28-weeks PD, additional serum specimens were collected. Intensitometric data from enzyme-linked immunoelectrotransfer blot (EITB) were obtained on IgA responses to a 17-kD antigen group, IgM responses to a 27-kD antigen group, and IgG responses to 27-, 17-, and 15-kD antigen groups extracted from oocysts. In addition, IgG responses to crude oocyst antigens were obtained by ELISA. Based on reported symptoms, EITB results, and stool examination, the crew members were classified as confirmed (10), probable (10), suspected (22), and noncases (16). Of the 10 confirmed cases (all symptomatic) and the 10 probable cases (eight symptomatic) whose stools were positive and negative, respectively, for *Cryptosporidium* oocysts by microscopy, all showed changes in EITB intensities to the antigen groups and were considered EITB positive. The remaining 38 crew members, 22 suspected cases (all symptomatic), and 16 noncases (all asymptomatic), if tested, had negative stool examinations and were considered EITB negative. Of the 10 confirmed cases, only four showed a significant change in IgG responses ( $p < 0.05$ ) between three-weeks PD and follow-up serum specimens by ELISA. Crew members considered confirmed cases consumed significantly more water ( $p \leq 0.005$ ) aboard the cutter than noncases. Crew members considered EITB positive consumed more water ( $p \leq 0.04$ ) than crew members considered EITB negative while there was no significant difference in water consumption ( $p = 0.19$ ) between crew members considered ELISA positive and ELISA negative. Using the EITB, the observation of changes in intensity of IgA responses to the 17-kD antigen group, IgM responses to the 27-kD antigen group, and IgG responses to the 27-, 17-, and 15-kD antigen groups from *C. parvum* oocysts between acute and convalescent serum specimens

appears useful for immunodiagnosis of *Cryptosporidium* infection and for prospective epidemiologic studies designed to monitor infection risk."

**1 8 3 Mukhopadhyay AK, Basu A, Garg P, Bag PK, Ghosh A, Bhattacharya SK, Takeda Y, Nair GB. Molecular epidemiology of reemergent *Vibrio cholerae* O139 Bengal in India (note). J Clin Microbiol 1998 Jul;36(7):2149-52. 27 ref, Eng. National Institute of Cholera & Enteric Diseases, P-33, CIT Road, Scheme, XM, Beliaghata, Calcutta 700010, India**

**1 8 4 Muniesa M, Jofre J. Abundance in sewage of bacteriophages that infect *Escherichia coli* O157:H7 and that carry the Shiga toxin 2 gene. Appl Environ Microbiol 1998 Jul; 64(7):2443-8. 39 ref, Eng. Department of Microbiology, University of Barcelona, Avenida Diagonal 645, Barcelona 08028, Spain**

**1 8 5 Nakasone N, Honma Y, Toma C, Yamashiro T, Iwanaga M. Filamentous phage fs1 of *Vibrio cholerae* O139. Microbiol Immunol 1998;42(3):237-9. 11 ref, Eng. Department of Bacteriology, University of the Ryukyus, School of Medicine, 207 Uehara, Okinawa 903-0215, Japan**

**1 8 6 Nakayama S-I, Watanabe H. Identification of *cpxR* as a positive regulator essential for expression of the *Shigella sonnei virF* gene. J Bacteriol 1998 Jul; 180(14):3522-8. 33 ref, Eng. Department of Bacteriology, National Institute of Infectious Diseases, Toyama 1-23-1, Shinjuku-ku, Tokyo 162, Japan**

"*virF* is the master regulator which activates the virulence determinant genes of *Shigella* spp. such as *ipaBCD* and *virG*. We previously reported that expression of *virF* itself is regulated in a pH-dependent manner and that *cpxA*, a sensor of a two-component regulatory system, is involved in this regulation (S. Nakayama and H. Watanabe, J. Bacteriol. 177:5062-5069, 1995). Disruption of *cpxR*, which has been thought to be the cognate response regulator of *cpxA* (J. Dong, S. Iuchi, H.-S. Kwan, Z. Lue, and E.C.C. Lin, Gene 136:227-230, 1993), abolished *VirF* expression almost completely. Purified CpxR bound directly to the upstream region of *virF*. Binding capacity was enhanced when CpxR was phosphorylated by incubation with acetyl phosphate in vitro. Furthermore, we observed that phosphorylated CpxR could activate *virF* transcription in vitro. These results clearly indicated that CpxR was an essential activator for *virFI* expression and strongly suggested that the binding of phosphorylated CpxR to the

target site upstream of the *virF* gene induced a direct activation of *virF* transcription."

**1 8 7 Newburg DS, Peterson JA, Ruiz-Palacios GM, Matson DO, Morrow AL, Shults J, de Lourdes Guerrero M, Chaturvedi P, Newburg SO, Scallan CD, Taylor MR, Ceriani RL, Pickering LK. Role of human-milk lactadherin in protection against symptomatic rotavirus infection. Lancet 1998 Apr 18;351(9110):1160-4. 30 ref, Eng. Shriver Center, 200 Trapelo Road, Waltham, MA 02254, USA**

**1 8 8 Okhuysen PC, Chappell CL, Crabb J, Valdez LM, Douglass ET, DuPont HL. Prophylactic effect of bovine anti-*Cryptosporidium* hyperimmune colostrum immunoglobulin in healthy volunteers challenged with *Cryptosporidium parvum*. Clin Infect Dis 1998 Jun;26(6):1324-9. 35 ref, Eng. Division of Infectious Diseases, The University of Texas Medical School and School of Public Health, 6431 Fannin, 1.728 JFB, Houston, Texas 77030, USA**

**1 8 9 Pal S, Datta A, Nair GB, Guhathakurta B. Use of monoclonal antibodies to identify phospholipase C as the enterotoxic factor of the bifunctional hemolysin-phospholipase C molecule of *Vibrio cholerae* O139 (note). Infect Immun 1998 Aug;66(8):3974-7. 22 ref, Eng. National Institute of Cholera & Enteric Diseases, Department of Biochemistry, P-33, CIT Road, Scheme XM, Beliaghata, Calcutta 700010, India**

**1 9 0 Parashar UD, Holman RC, Bresee JS, Clarke MJ, Rhodes PH, Davis RL, Thompson RS, Mullooly JP, Black SB, Shinefield HR, Marcy SM, Vadheim CM, Ward JI, Chen RT, Glass RI. Epidemiology of diarrheal disease among children enrolled in four West Coast health maintenance organizations. Pediatr Infect Dis J 1998 Jul;17(7):605-11. 16 ref, Eng. Viral Gastroenteritis Section, Mailstop-G04, Centers for Disease Control and Prevention, 1600 Clifton Road, N.E., Atlanta, GA 30333, USA**

"**Background.** We used information from the Vaccine Safety Datalink (VSD) about ~1 million children enrolled in four health maintenance organizations to assess the morbidity from diarrhea and estimate the disease burden of rotavirus. **Methods.** We examined trends of diarrhea-associated hospitalizations and emergency room (ER) visits among VSD children aged 1 month through 4 years during October, 1992, through September, 1994 (two rotavirus seasons) and estimated

the morbidity from rotavirus on the basis of characteristic patterns of age and seasonality. **Results.** Overall diarrhea was associated with 6.3% of hospitalizations and 4% of ER visits. During a child's first 5 years of life, we estimated that 1 in 57 was hospitalized and 1 in 21 required an ER visit because of diarrhea. Each year the number of diarrhea-associated hospitalizations and ER visits was greatest in winter among children ages 4 to 23 months and peaked in November in California and during February in Oregon and Washington. The winter seasonality of diarrhea-associated hospitalizations reflected the trends for diarrhea of presumed noninfectious and viral etiologies, which together accounted for most (92.9%) hospitalizations. **Conclusions.** Diarrhea is an important cause of morbidity among VSD children. The epidemiologic patterns of diarrhea-associated hospitalizations and ER visits resembled those reported previously for rotavirus diarrhea, suggesting that rotavirus may be a major contributor to the overall morbidity from diarrhea. Enhanced surveillance by screening for rotavirus in a sample of children with diarrhea will permit a more accurate assessment of the disease burden of this pathogen and the cost effectiveness of a rotavirus immunization program."

**191 Park S, Sestak K, Hodgins DC, Shoup DI, Ward LA, Jackwood DJ, Saif LJ. Immune response of sows vaccinated with attenuated transmissible gastroenteritis virus (TGEV) and recombinant TGEV spike protein vaccines and protection of their suckling pigs against virulent TGEV challenge exposure. Am J Vet Res 1998 Aug;59(8):1002-8. 27 ref, Eng.** Department of Medical Microbiology, College of Veterinary Medicine, University of Georgia, Athens, GA 30602, USA

**192 Parry SM, Salmon RL\*, Willshaw GA, Cheasty T. Risk factors for and prevention of sporadic infections with vero cytotoxin (Shiga toxin) producing *Escherichia coli* O157. Lancet 1998 Apr 4; 351(9108):1019-22. 23 ref, Eng.** \*Public Health Laboratory Service Communicable Disease Surveillance Center (Wales), Abton House, Cardiff CF4 3QX, UK

**193 Paton JC, Paton AW. Pathogenesis and diagnosis of Shiga toxin-producing *Escherichia coli* infections. Clin Microbiol Rev 1998 Jul;11(3):450-79. 383 ref, Eng.** Molecular Microbiology Unit, Women's and Children's Hospital, North Adelaide, S.A. 5006, Australia

**194 Perry RT, Plowe CV, Koumare B, Bougoudogo F, Kotloff KL, Losonsky GA, Wasserman SS, Levine MM\*. A single dose of live oral cholera vaccine CVD 103-HgR is safe and immunogenic in HIV-infected and HIV-noninfected adults in Mali. Bull WHO 1998;76(1):63-71. 54 ref, Eng.** \*Center for Vaccine Development, University of Maryland School of Medicine, Baltimore, MD 21201, USA

"Despite considerable experience with single-dose, live, oral cholera vaccine CVD 103-HgR in Asia, Europe, and the Americas, the vaccine had not been evaluated in sub-Saharan Africa or on individuals infected with human immunodeficiency virus (HIV). We therefore conducted a randomized, placebo-controlled, double-blind, cross-over clinical trial in 38 HIV-seropositive (without clinical acquired immunodeficiency syndrome (AIDS) and 387 HIV-seronegative adults in Mali to assess its safety and immunogenicity. Adverse reactions (fever, diarrhoea and vomiting) were observed with similar frequency among vaccine and placebo recipients. The vaccine strain was not isolated from the coprocultures of any subject. The baseline geometric mean titre (GMT) of serum vibriocidal antibody was significantly lower in HIV-seropositives (1:23) than in HIV-seronegatives (1:65) ( $P=0.002$ ). Significant rises in vibriocidal antibody were observed in 71% of HIV-seronegatives and 58% of HIV-seropositives, and in 40% of HIV-seropositives with  $CD4^+$  counts below 500 per ml. Following immunization, the peak vibriocidal GMT in HIV-seronegatives was 1:584 versus 1:124 in HIV-seropositives ( $P=0.0006$ ); in HIV-seropositives with  $CD4^+$  counts <500 per ml, the peak vibriocidal GMT was 1:40 ( $P=0.03$  versus other HIV-seropositives). CVD 103-HgR was safe in HIV-infected Malian adults, although serological responses were significantly attenuated among HIV-seropositives (particularly in those with  $CD4^+$  counts <500 per ml) relative to HIV-seronegatives. These results encourage further evaluations of this single-dose, oral cholera vaccine in high-risk populations such as refugees in sub-Saharan Africa."

**195 Porat N, Levy A, Fraser D, Deckelbaum RJ, Dagan R\*. Prevalence of intestinal infections caused by diarrheagenic *Escherichia coli* in Bedouin infants and young children in southern Israel. Pediatr Infect Dis J 1998 Jun;17(6):482-8. 37 ref, Eng.** \*Pediatric Infectious Disease Unit, Soroka University Medical



Center, Faculty of Health Sciences, Ben-Gurion University of the Negev, PO Box 151, Beer-Sheva 84101, Israel

**Objective.** To evaluate the prevalence of different *Escherichia coli* categories in symptomatic and asymptomatic infants and children residing in a Bedouin township in Southern Israel. **Methods.** A total of 1613 stool samples were collected from a cohort of 234 infants and young children followed from birth up to 2 years of age. *E. coli* colonies from stool cultures from children during a diarrhea episode and those from nondiarrhea stools were hybridized with DNA probes specific for enteropathogenic, enteroinvasive, enterotoxigenic (ETEC), enteroaggregative, diffuse adherent and enterohemorrhagic strains. **Results.** There were 1469 of 1613 (91%) samples positive for *E. coli*. The prevalence of *E. coli* categories was: enteroaggregative (25.9%); diffuse adherent (21.8%), ETEC (12.9%); enteropathogenic (7.3%); enterohemorrhagic (0.5%); and enteroinvasive (0.2%). ETEC, expressing the heat-stable enterotoxin (ST), was the only category isolated significantly more often from cases than from controls ( $P=0.005$ ). Of the two heat-stable enterotoxins screened in this study, only ETEC-heat stable enterotoxin (STh), the form isolated from human pathogenic ETEC, could be associated with diarrhea, whereas ETEC-STp, produced by ETEC of porcine origin, was not related to diarrhea. ETEC infections peaked during the warm, dry season. Prolonged shedding of *E. coli* postdiarrhea was not found in this population. **Conclusion.** The present cohort study confirmed that in this semiurban area, highly endemic for diarrheal disease, ETEC is an important cause of diarrhea in children.”

**196 Purohit SG, Kelkar SD\*, Simha KV. Time series analysis of patients with rotavirus diarrhoea in Pune, India. J Diarrhoeal Dis Res 1998 Jun;16(2):74-83. 19 ref, Eng.** \*Department of Statistics, Abasaheb Garware College, Pune 411004, India

“The effects of seasonality and other temporal patterns on the occurrence of rotavirus diarrhoea were studied among hospitalised cases at Pune, India from July 1992 to June 1996. The well-accepted Box-Jenkins methodology based on modelling was employed for the analysis. This is the first presentation of such analysis for rotavirus diarrhoea. The model suggests strong influence of climatic changes on the incidence of the disease. Further study of weather parameters not only confirms

that daily minimum temperature is the principal factor but also reveals that easterly wave, a characteristic feature of tropical weather, is useful in predicting the peak of hospital admissions and the geographical sequence of outbreaks of the disease in tropical India.”

**197 Qadri F, Makela PH, Holmgren J, Albert MJ, Mannoor K, Kantele A, Saha D, Salam MA, Kantele JM. Enteric infections in an endemic area induce a circulating antibody-secreting cell response with homing potentials to both mucosal and systemic tissues. J Infect Dis 1998 Jun;177(6):1594-9. 41 ref, Eng.** National Public Health Institute, Mannerheimintie 166, FIN-00300 Helsinki, Finland

“Enteric infections induce a response of circulating pathogen-specific antibody-secreting cells (ASC). The expression of homing receptors (HRs) on these cells was studied in patients with diarrhea caused by *Vibrio cholerae* in Bangladesh, an area in which cholera is endemic. The gut HR,  $\alpha_4\beta_7$ , was expressed by ~80% of the ASC, indicating mucosal homing of these cells. However, the peripheral lymph node HR, L-selectin, was also expressed by ~80% of the ASC specific to either cholera toxin or O antigen. In earlier findings after oral immunization in nonendemic areas,  $\alpha_4\beta_7$ , has been expressed by ~100% and L-selectin by ~50% of the ASC. In comparison, the present data speak for a more systemic targeting of the immune response associated with long-lasting immunity in an endemic area. The results thus provide insight for the continued development and evaluation of vaccines.”

**198 Ramachandran M, Vij A, Kumar R, Das BK, Gentsch JR, Bhan MK, Glass RI. Lack of maternal antibodies to P serotypes may predispose neonates to infections with unusual rotavirus strains. Clin Diagn Lab Immunol 1998 Jul;5(4):527-30. 23 ref, Eng.** Viral Gastroenteritis Section, MS G04, Centers for Disease Control and Prevention (CDC), 1600 Clifton Road, NE, Atlanta, GA 30333, USA

“Rotavirus (RV) strains infecting newborns often have unique neutralization antigens (P serotypes) on their outer capsids that are distinct from those found on RV strains that cause diarrhea in older children. We examined the hypothesis that unusual RV strains preferentially infect newborns because the newborns lack maternal neutralizing antibodies to these strains. To test this hypothesis, sera and saliva samples collected from neonates infected with 116E-like (P[11]G9) strains

in the maternity ward of the All India Institute of Medical Sciences (AIIMS) hospital in New Delhi were tested for neutralizing antibodies against common RV strains and those infecting newborns and these titers were compared with those of newborns who did not become infected (controls). The infected neonates had significantly lower levels of cord blood neutralizing antibodies to 116E than the controls, suggesting that immunity to neonatal RV infection is acquired transplacentally through maternal antibodies. Further, this study confirmed the immunogenicity of the AIIMS neonatal strain 116E, a vaccine candidate, in its ability to evoke a potent RV-specific immunoglobulin A and neutralizing antibody response in serum and saliva among the infected babies. Our findings have important implications for the development of an effective RV vaccine. In India, where G9 strains are common in the community, the use of 116E as a vaccine, together with the rhesus tetravalent vaccine, may provide a broader protection against all the circulating RV serotypes, including serotype G9, which is not represented in the current rhesus RV tetravalent vaccine (G1-G4)."

**1 9 9 Raufman J-P. Cholera. Am J Med 1997 Apr;104(4):386-94. 27 ref, Eng.** Division of Gastroenterology, University of Arkansas for Medical Sciences-Slot 567, 4301 W. Markham Street, Little Rock, Arkansas 72205-7199, USA

**2 0 0 Rhoads JM. Oral rehydration pudding? (editorial) J Pediatr Gastroenterol Nutr 1998 Jul;27(1):114-5. 18 ref, Eng.** Department of Pediatrics, CH # 7220, 310 Burnett Womack Building, Chapel Hill, NC 27599, USA

**2 0 1 Rönnblom A, Andersson S, Danielsson A. Mechanisms of diarrhoea in myotonic dystrophy. Eur J Gastroenterol Hepatol 1998 Jul;10(7):607-10. 17 ref, Eng.** Department of Internal Medicine, University Hospital, S-751 85 Uppsala, Sweden

**"Background:** Gastrointestinal (GI) symptoms are common in myotonic dystrophy (MD). Diarrhoea is one of the more disabling of these GI complaints. The mechanisms behind diarrhoea in MD have not previously been investigated systematically. **Objective:** To elucidate the mechanisms behind diarrhoea in MD. **Methods:** Twenty patients with MD and suffering from diarrhoea were investigated in order to detect malabsorption (blood tests and faecal fat excretion) and bile acid malabsorption {[<sup>75</sup>Se]selenahomocholic acid-taurine (SeHCAT)

retention) and to study intestinal morphology (duodenal and rectal biopsies). **Results:** Two patients had deficiency of folic acid and four showed reduced levels of pancreatic isoamylase, but none of them had steatorrhoea. Two out of eight patients had abnormal bile acid breath tests with normal SeHCAT, indicating small bowel bacterial overgrowth and 12 displayed reduced SeHCAT retention. Duodenal biopsies were normal in eight patients and five out of nine rectal biopsies displayed slight inflammation. **Conclusions:** A possible mechanism of diarrhoea in MD could be identified in most of the patients. Bile acid malabsorption seems to be a frequent cause and can be treated successfully."

**2 0 2 Sack DA, Lastovica AJ, Chang SH, Pazzaglia G. Microtiter assay for detecting Campylobacter spp. and Helicobacter pylori with surface gangliosides which bind cholera toxin. J Clin Microbiol 1998 Jul;36(7):2043-5. 26 ref, Eng.** Johns Hopkins University Vaccine Testing Unit, 550 N. Broadway, Suite 1001, Baltimore, MD 21205, USA

**"Campylobacter jejuni** with Gm1 ganglioside in the core of its lipopolysaccharide has been associated with Guillain-Barré syndrome. Since this epitope may be of considerable pathophysiologic importance and since this ganglioside binds cholera toxin, a rapid screening assay to detect bacteria that bind cholera toxin as an indication of Gm1 on their surfaces was developed. In the assay, bacterial lawns were grown on agar plates, harvested with phosphate-buffered saline, boiled, and incubated with a standard concentration of cholera B subunit. Preparations from strains with Gm1 were observed to inhibit the binding of cholera B subunit to Gm1 in a microtiter enzyme-linked immunosorbent assay. By using this assay with two groups of strains, 37 positive strains were detected among the 197 tested. Species with positive isolates included *C. jejuni*, *Campylobacter coli*, and *Helicobacter pylori*. The assay is capable of testing large numbers of isolates and should prove useful in future clinical and epidemiological studies of bacteria with this epitope."

**2 0 3 Sanchez JL, Gelnett J, Petruccioli BP, Defraites RE, Taylor DN. Diarrheal disease incidence and morbidity among United States military personnel during short-term missions overseas. Am J Trop Med Hyg 1998 Mar;58(3):299-304. 26 ref, Eng.** Epidemiology and Disease Surveillance Directorate, U.S. Army Center for Health Promotion and

Preventive Medicine, PO Box 836, Aberdun Proving Ground, MD 21005-0836, USA

**2 0 4 Santos N, Lima RCC, Pereira CFA, Gouvea V. Detection of rotavirus types G8 and G10 among Brazilian children with diarrhea (note). J Clin Microbiol 1998 Sep;36(9):2727-9. 17 ref, Eng.** Departamento de Virologia, Instituto de Microbiologia, Universidade Federal do Rio de Janeiro, Cidade Universitaria-CCS-BL. I-Ilha do Fundao, PO Box 68040, Rio de Janeiro 21941-590, Brazil

**2 0 5 Saslow SB, Scolapio JS, Camilleri M, Forstrom LA, Thomforde GM, Burton DD, Rubin J, Pitot HC, Zinsmeister AR. Medium term effects of a new 5HT<sub>3</sub> antagonist, alosetron, in patients with carcinoid diarrhoea. Gut 1998 May;42(5):628-34. 32 ref, Eng.** Mayo Clinic, Gastroenterology Unit, Alfred 2-435, 200 First St SW, Rochester, Minnesota 55905, USA

**“Background**—Carcinoid diarrhoea is associated with rapid small bowel and proximal colonic transit. Intravenous administration of a serotonin type 3 receptor (5HT<sub>3</sub>) antagonist restores postprandial colonic tone towards normal in carcinoid patients. **Aims**—To evaluate the medium term effects of an oral 5HT<sub>3</sub> antagonist, alosetron, on symptoms, stool fat, and transit in patients with carcinoid diarrhoea. **Methods**—In 27 patients with carcinoid diarrhoea, symptoms were recorded daily and gastrointestinal transit was measured by scintigraphy in a three dose (0.1, 0.5, 2.0 mg, twice daily), randomised (1:1:1), parallel group, four week study. Placebo was given during the first week. Loperamide (2 mg capsules) was used as rescue medication. **Results**—There were numerical improvements in median diarrhoea score, stool weight, loperamide use, and overall colonic transit at four hours, but no overall significant drug effect was shown. Alosetron reduced the proximal colon emptying rate ( $p < 0.05$  in 20 evaluable comparisons), but did not significantly alter small bowel transit. **Conclusions**—Alosetron retardation of proximal colonic emptying in patients with carcinoid diarrhoea confirms the potential role of a 5HT<sub>3</sub> mechanism in this disorder. Doses of alosetron higher than 2.0 mg twice daily will be required for symptomatic benefit in carcinoid diarrhoea.”

**2 0 6 Sengupta B, Dasgupta S, Saha I, Mandal AK, Palodhi PKR. Experience in running a Diarrhoeal Training cum Treatment Unit (DTTU) in a state teaching hospital in Calcutta. J Indian Med Assoc 1998 Apr;96(4):104-5. 9 ref, Eng.** NRS Medical College and Hospital, Calcutta 700014, India

**2 0 7 Sharma C, Ghosh A, Ghosh RK, Mukhopadhyay AK, Nair GB. Molecular analysis of the cholera toxin gene & antibiotic sensitivity profile of *Vibrio cholerae* O1 & O139 associated with mixed infection. Indian J Med Res 1998 May;107:199-203.** Institute of Microbial Technology, Sector 39-A, Chandigarh 160036, India

“In the context of the reemergence of *V. cholerae* O1 in India and the recent evidence that O139 strains could have evolved from O1 El Tor strains, restriction fragment length polymorphism (RFLP) of the *rRNA* and the *ctx* genes and the antibiotic sensitivity profile of the two strains of *V. cholerae*, one an O1 and the other an O139, associated with mixed infection, were examined to determine their relatedness. Our results demonstrate that although the strains belonged to different clones of *V. cholerae*, they showed similar antibiotic sensitivity profile indicating some exchange of genetic elements.”

**2 0 8 Sikder ZU. Management of diarrhoea during Bangladesh Liberation war. Annals 1996 Dec;9-14. 15 ref, Eng.** Bangladesh College of General Practitioners, 215/A Outer Circular Road, Dhaka 1217, Bangladesh

**2 0 9 Silva AC, Santos-Neto MS, Soares AM, Fonteles MC, Guerrant RL, Lima AAM\*. Efficacy of a glutamine-based oral rehydration solution on the electrolyte and water absorption in a rabbit model of secretory diarrhea induced by cholera toxin. J Pediatr Gastroenterol Nutr 1998 May;26(5):513-9. 28 ref, Eng.** \*Department of Physiology, Health Sciences Center, Federal University of Ceara, Fortaleza, Brazil

**“Background:** Glutamine is absorbed in the intestinal tract coupled with sodium and is the principal metabolic substrate for the enterocyte. Therefore, an oral rehydration solution containing this substance might provide an effective oral means of restoring electrolyte losses as well as speeding repair of mucosal damage. The objective of this work was to investigate the use of an oral rehydration solution based on glutamine in vivo in the perfused rabbit ileal loop model of secretory diarrhea induced by choleratoxin. **Methods:** Phenol-sulfonphthalein (PSP, 50 mg/l) was used as a nonabsorbable marker for calculations of net water and electrolyte transport. Solutions tested included: (a) a glutamine-based oral rehydration solution with 111 mmol/l glutamine, (Gln-ORS); (b) the oral rehydration

solution recommended by the World Health Organization; (c) modified Ringer's solution. Cholera toxin (1 mg/ml) was injected into the lumen of the ileal rabbit segments for 30 minutes prior to the initiation of the perfusion. **Results:** Cholera toxin induced significant secretion of sodium in the control modified Ringer's solution ( $10.8 \pm 2.95$  vs  $-14.05 \pm 5.95$   $\mu\text{Eq/g/min}$ ,  $n = 10$ ;  $P < 0.01$ ) and of water ( $0.06 \pm 0.03$  vs  $-0.15 \pm 0.06$  ml/g/min,  $n = 10$ ;  $P < 0.01$ ) with a maximum effect at 60 minutes after initiation of perfusion. World Health Organization oral rehydration solution was able to significantly reduce the intestinal secretion of sodium (control with cholera =  $-14.34 \pm 2.18$  vs oral rehydration solution with cholera =  $-0.50 \pm 0.48$   $\mu\text{Eq/g/min}$ ,  $n = 10$ ;  $P < 0.01$ ) and water ( $-0.5 \pm 0.02$  vs  $-0.012 \pm 0.005$  ml/g/min,  $n = 10$ ;  $P < 0.01$ ). For comparison, glutamine-based oral rehydration solution had an even greater effect on sodium and water absorption (glutamine-based oral rehydration solution with cholera toxin =  $10.31 \pm 1.21$   $\mu\text{Eq/g/min}$ ,  $n = 5$ ;  $P < 0.01$  for sodium and  $0.08 \pm 0.008$  ml water/g/min;  $n = 5$ ;  $P < 0.01$ ). Cholera toxin did not change the effect of glutamine-based oral rehydration solution on sodium and water absorption ( $12.90 \pm 1.09$   $\mu\text{Eq sodium/g/min}$ ,  $n = 5$ ; and  $0.11 \pm 0.01$  ml water/g/min;  $n = 5$ ). In addition glutamine-based oral rehydration solution also induced a greater absorption of potassium and chloride in the intestinal ileal segments treated with cholera toxin compared with World Health Organization glutamine-based oral rehydration solution. **Conclusions:** These results demonstrate the superior efficacy of glutamine-based oral rehydration solution in electrolyte and water absorption compared with modified Ringer's control solution or even with World Health Organization-recommended oral rehydration solution."

**210 Sing J, Sachdeva V, Bhatia R, Bora D, Jain DC, Sokhey J. Endemic cholera in Delhi, 1995: analysis of data from a sentinel centre. J Diarrhoeal Dis Res 1998 Jun;16(2):66-73. 32 ref, Eng.** National Institute of Communicable Diseases, 22-Sham Nath Marg, Delhi 110054, India

"Data on cholera cases admitted to the Delhi Infectious Diseases Hospital (IDH) are presented to describe the pattern of occurrence of cholera in Delhi in 1995. Rectal swabs from 4082 cases of acute diarrhoea admitted to the IDH were examined for excretion of *Vibrio cholerae*. Of them, 2004 (49%) and 4 (0.1%) were positive for *V.*

*cholerae* O1 biotype El Tor and *V. cholerae* O139 respectively. Most cholera cases occurred during May - September (summer and monsoon months). The period from January to March (winter) was completely free from cholera. The urban areas were not affected uniformly. Of the 80 PIN (Postal Index Number) code areas, 10 contributed to 57% of the cases. The early cases were scattered in PIN code areas distant from one another. The hospitalisation rates for cholera were the highest in children aged less than five years and declined significantly with increasing patients' age. Males had significantly higher rates than females aged up to 20 years, whereas the situation was reversed in the 20 to 39 year age group. Four per cent of the affected families had multiple cases. An estimated 1% of the household contacts of hospitalised cases of cholera were themselves hospitalised for cholera within 2 days of the first admission. Of the 260 *V. cholerae* O1 isolates tested, 4%, 7%, 8%, 89%, 91% and 95% were resistant to tetracycline, nalidixic acid, chloramphenicol, cotrimoxazole, streptomycin, and furazolidone respectively. The study highlights the usefulness of surveillance data to identify groups, urban areas and seasons with increased risk for cholera and to allow control measures to be focussed on those in greatest need."

**211 Souza DFC, Kisielius JJ, Ueda M, Gabbay YB, Carmona RCC, Timenetsky MDCST, Mascarenhas JDP, Takimoto S, Tanaka H\*. An outbreak of group C rotavirus gastroenteritis among adults living in Valentim Gentil, Sao Paulo State, Brazil. J Diarrhoeal Dis Res 1998 Jun;16(2):59-65. 36 ref, Eng.** \*Electron Microscopy Section, Adolfo Lutz Institute, Av. Dr. Arnaldo no. 355 Cerqueira Cesar, CEP 01246-902, Sao Paulo, Brazil

"An outbreak of gastroenteritis affecting adults and children occurred in the small city of Valentim Gentil, São Paulo, Brazil, in 1993. Nineteen faecal samples (from 10 cases and 9 contacts) were examined by direct electron microscopy (DEM), immune electron microscopy (IEM), polyacrylamide gel electrophoresis (PAGE), and enzyme-linked immunosorbent assay (ELISA) for group A and C rotaviruses. DEM detected rotavirus in 6 of the 10 cases and in none of the contacts. All of the samples were negative for group A rotavirus by ELISA. Analysis by PAGE showed an electrophoretic profile suggestive of group C rotavirus in two cases. Group C rotavirus was identified by IEM in 4 of the cases

and in 1 of the contacts. All of the samples were submitted to ELISA for group C rotavirus. This resulted in a total of 10 positives – 7 for diarrhoeal cases and 3 for contacts. This outbreak was strongly associated with group C rotavirus. The importance of combining different diagnostic methods is emphasised.”

**2 1 2 Spencer RC. Clinical impact and associated costs of *Clostridium difficile*-associated disease. J Antimicrob Chemother 1998 May;41(Suppl C):5-12. 98 ref, Eng.** Bristol Public Health Laboratory, Level 8, Bristol Royal Infirmary, Marlborough Street, Bristol BS2 8HW, UK

**2 1 3 Sprinz E, Mallman R, Barcellos S, Silbert S, Schestatsky G, David DB. AIDS-related cryptosporidial diarrhoea: an open study with roxithromycin. J Antimicrob Chemother 1998 Mar;41(Suppl B):85-91. 31 ref, Eng.** Department of Internal Medicine, Infectious Diseases Unit, Hospital de Clinicas de Porto Alegre, Rua Ramiro Barcellos, 2350 6º andar Sul, 90035-003, Rio Grande do Sul, Brazil

“In immunocompromised patients, cryptosporidial diarrhoea is a debilitating and potentially life-threatening infection for which no effective specific therapy exists. In an uncontrolled study of 24 AIDS patients with diarrhoea exclusively due to *Cryptosporidium* spp., treatment with roxithromycin, 300 mg bd for 4 weeks, produced symptomatic improvement of diarrhoea in 79% of cases, with 50% of patients achieving complete response. The response rate was 100% in a subgroup of five patients with no previous or concomitant opportunistic infections. In complete responders, improvement was rapid, occurring within 3-5 days, and the duration of response was at least 6 months. Response did not appear to be correlated with the degree of immunodeficiency. The most limiting adverse effects were abdominal pain (two patients), elevated hepatic enzymes (two patients) and abdominal pain with elevated hepatic enzymes (one patient). Minor symptoms, such as gastrointestinal upset, occurred in nine patients. We conclude that roxithromycin is relatively well tolerated and effective against cryptosporidial diarrhoea in AIDS patients. Further studies to optimize dosing regimens are required.”

**2 1 4 Steele AD, Kasolo FC, Bos P, Peenze I, Oshitani H, Mpabalwani E. Characterization of VP6 subgroup, VP7 and VP4 genotype of rotavirus strains in Lusaka, Zambia. Ann Trop Pediatr 1998**

**Jun;18(2):111-6. 28 ref, Eng.** MRC/MEDUNSA Diarrhoeal Pathogens Research Unit, PO 173, MEDUNSA 0204, Pretoria, South Africa

**2 1 5 Steele M, McNab B, Fruhner I, DeGrandis S, Woodward D, Odumeru JA. Epidemiological typing of *Campylobacter* isolates from meat processing plants by pulsed-field gel electrophoresis, fatty acid profile typing, serotyping, and biotyping. Appl Environ Microbiol 1998 Jul;64(7):2346-9. 24 ref, Eng.** Laboratory Sciences Division, University of Guelph, 95 Stone Road W., Guelph, Ontario N1H 8J7, Canada

**2 1 6 Stoltzfus RJ, Albonico M, Chwaya HM, Tielsch JM, Schulze KJ, Savioli L. Effects of the Zanzibar school-based deworming program on iron status of children. Am J Clin Nutr 1998 Jul;68(1):179-86. 35 ref, Eng.** Center for Human Nutrition, Department of International Health, The Johns Hopkins School of Public Health, 615 North Wolfe Street, Baltimore, MD 21205, USA

“We evaluated the effects of the Zanzibar school-based deworming program on the iron status of primary school children. Parasitologic and nutritional assessments were carried out at baseline, 6 mo, and 12 mo in 4 nonprogram schools ( $n=1002$ ), 4 schools in which students received twice-yearly deworming ( $n=952$ ), and 4 schools in which students received thrice-yearly deworming ( $n=970$ ) with 500 mg generic mebendazole. Schools were randomly selected for evaluation and allocated to program groups. Relative to no treatment, thrice-yearly deworming caused significant decreases in protoporphyrin concentrations and both deworming regimens caused marginally significant increases in serum ferritin concentrations. The average annual changes in protoporphyrin concentrations were -5.9 and -23.5 mmol/mol heme in the control and thrice-yearly deworming groups, respectively ( $P<0.001$ ). The average changes in ferritin concentration were 2.8 and 4.5 mg/L, respectively ( $P=0.07$ ). Deworming had no effect on annual hemoglobin change or prevalence of anemia. However, the relative risk of severe anemia (hemoglobin  $<70$  g/L) was 0.77 (95% confidence limits: 0.39, 1.51) in the twice-yearly deworming group and 0.45 (0.19, 1.08) in the thrice-yearly deworming group. The effects on prevalence of high protoporphyrin values and incidence of moderate-to-severe anemia (hemoglobin  $<90$  g/L) were significantly greater in children with  $>2000$  hookworm eggs/g feces at baseline. We estimate that this deworming program prevented 1260 cases of moderate-

to-severe anemia and 276 cases of severe anemia in a population of 30,000 school children in 1 y. Where hookworm is heavily endemic, deworming programs can improve iron status and prevent moderate and severe anemia, but deworming may be needed at least twice yearly."

**2 1 7 Superti F, Amici C, Tinari A, Donelli G, Santoro MG. Inhibition of rotavirus replication by prostaglandin A: evidence for a block of virus maturation. J Infect Dis 1998 Aug;178(2):564-8. 15 ref, Eng.** Institute of Experimental Medicine, CNR, Viale K. Marx, 15/43, 00137 Rome, Italy

"Rotaviruses are recognized as the leading cause of severe viral gastroenteritis in young children and in immunocompromised patients. Cyclopentenone prostaglandins possess antiviral activity against several single-strand RNA viruses; therefore, the effect of prostaglandin A<sub>1</sub> (PGA<sub>1</sub>) on SA-11 simian rotavirus infection was investigated in cultured cells. PGA<sub>1</sub> potently inhibited SA-11 rotavirus replication. Whereas it did not affect virus absorption or penetration, PGA<sub>1</sub> partially inhibited VP4 and VP7 synthesis and selectively reduced glucosamine incorporation into the NSP4 viral enterotoxin. Electron microscopy analysis showed that, despite normal formation of cytoplasmic inclusions and budding of particles into the rough endoplasmic reticulum, virus maturation was impaired in PGA<sub>1</sub>-treated cells, with most of the virus particles remaining in the membrane-enveloped intermediate form. Because prostaglandins are used clinically as cytoprotective drugs for gastric ulcers, these observations offer new perspectives in the search for therapeutic agents for rotavirus-induced gastroenteritis."

**2 1 8 Takala AK, Koskenniemi E, Joensuu J, Mäkelä M, Vesikari T. Economic evaluation of rotavirus vaccinations in Finland: randomized, double-blind, placebo-controlled trial of tetravalent rhesus rotavirus vaccine. Clin Infect Dis 1998 Aug;27(2):272-82. 6 ref, Eng.** Department of Vaccines, National Public Health Institute, Mannerheimintie 166, 00300 Helsinki, Finland

"The cost-benefit ratio of tetravalent rhesus rotavirus vaccine (RRV-TV) in Finland for prevention of rotavirus gastroenteritis was assessed in a randomized, double-blind, placebo-controlled trial. Costs related to vaccination, side effects, and gastroenteritis were identified. Children received RRV-TV (n=1,191) or

placebo (n=1,207) at 2, 3, and 5 months of age with other infant vaccinations. Prospective follow-up averaged 1.0 years per child. An intention-to-treat analysis was performed from the perspective of society. Nine cases of severe rotavirus gastroenteritis occurred in the RRV-TV group, versus 100 in the placebo group (P<.0001); mean cost per vaccinated child was 4 Finnish marks (FIM) in the RRV-TV group, versus 203 FIM in the placebo group. Side effects with related costs occurred after 11% and 7% of doses in the RRV-TV group and placebo group, respectively (P<.001); mean cost per child was 89 FIM vs. 75 FIM. The break-even cost (i.e., net benefit, excluding cost of vaccine) of RRV-TV in prevention of severe rotavirus gastroenteritis was 109 FIM (U.S. \$19.60) per child."

**2 1 9 Tamamoto T, Nakashima K, Nakasone N, Honma Y, Higa N, Yamashiro T. Adhesive property of toxin-coregulated pilus of *Vibrio cholerae* O1. Microbiol Immunol 1998;42(1):41-5. 23 ref, Eng.** Department of Bacteriology, Faculty of Medicine, University of the Ryukyus, 207 Uehara, Nishihara, Okinawa 903-01, Japan

**2 2 0 Tremblay C, Gaudreau C. Antimicrobial susceptibility testing of 59 strains of *Campylobacter fetus* subsp. *fetus* (note). Antimicrob Agents Chemother 1998 Jul; 42(7):1847-9. 29 ref, Eng.** Centre Hospitalier de l'Université de Montréal, Pavillon St-Luc, CHUM, 1058 rue St-Denis, Montréal, Québec, Canada H2X 3J4

**2 2 1 Uip DE, Lima ALL, Amato VS, Boulos M, Neto VA, David DB. Roxithromycin treatment for diarrhoea caused by *Cryptosporidium* spp. in patients with AIDS. J Antimicrob Chemother 1998 Mar;41(Suppl B):93-7. 20 ref, Eng.** Department of Infectious and Parasitic Diseases, Clinics Hospital of São Paulo University, Alameda Gabriel Monteiro da Silva, 429 01441-000 Brazil

"In view of the action of newer macrolide antibiotics on intracellular protozoa, we have investigated the efficacy of roxithromycin in the treatment of cryptosporidiosis in 26 patients with AIDS. Cryptosporidiosis was confirmed either by faecal examination for parasites (modified Kinyoun method) or by detection of the parasite in biopsy material obtained by colonoscopy. Patients received oral roxithromycin (300 mg bd) for 4 weeks. Twenty-two patients completed the study. At the end of the study, 15 patients (68%) were considered to be cured and six

patients (27%) improved, and treatment failed in one patient (5%). We conclude that roxithromycin is a useful treatment for diarrhoea caused by *Cryptosporidium* spp. associated with AIDS."

**2 2 2 Unicomb LE, Banu NN, Azim T, Islam A, Bardhan PK, Faruque ASG, Hall A, Moe CL, Noel JS, Monroe SS, Albert MJ, Glass RI\*. Astrovirus infection in association with acute, persistent and nosocomial diarrhea in Bangladesh. *Pediatr Infect Dis J* 1998 Jul;17(7):611-4. 18 ref, Eng. \*Viral Gastroenteritis Section, Mailstop G-04, Centers for Disease Control and Prevention, 1600 Clifton Road N.E., Atlanta, GA 30333, USA**

**"Background.** Diarrhea is an important public health concern in developing countries such as Bangladesh. Diarrhea in children that persists for 14 days or more occurs in 7% of patients in Bangladesh and frequently results in death. Astrovirus has been demonstrated as a cause of acute and nosocomial diarrhea and can be excreted for prolonged periods, yet its importance as a cause of diarrhea among children in a developing country like Bangladesh has not been investigated. **Methods.** We tested 629 stool specimens from patients with acute diarrhea, 153 from patients with persistent diarrhea, 175 specimens from 76 patients hospitalized for diarrhea who were sampled repeatedly to detect nosocomial infection and 428 from nonhospitalized healthy children (controls). All children enrolled in the study were <5 years of age. Astrovirus was detected by enzyme immunoassay and other enteropathogens were detected by standard techniques. **Results.** The detection of astrovirus increased significantly with the duration of diarrhea. Astrovirus was found in 23 (15%) specimens from patients with persistent diarrhea, 26 (4%) patients with acute diarrhea, but only 8 (2%) healthy controls. This trend remained when we limited our analysis to infants <12 months of age and to episodes in which astrovirus was the sole pathogen. Among patients with nosocomial diarrhea, 16% of postadmission specimens were positive for astrovirus when the admission specimen was negative. **Conclusion.** The observation that astrovirus is detected more frequently with diarrhea of increasing duration suggests the need for further studies to determine whether astrovirus plays a causative role in persistent diarrhea or is a secondary agent."

**2 2 3 Vaishnavi C. Antibiotic associated diarrhoea and enterocolitis. *Trop Gastroenterol* 1997 Oct-Dec;18(4):145-8. 45 ref, Eng. Department of**

Gastroenterology, Postgraduate Institute of Medical Education and Research, Chandigarh 160012, India

**2 2 4 Vazquez J, Boher Y, Perez M, Guntinas MJ, Rojas AM. Immune response to three doses of quadrivalent rotavirus vaccine: 1-year follow-up. *Vaccine* 1998 Jul;16(11/12):1179-83. 22 ref, Eng. Instituto de Medicina Experimental, Universidad Central de Venezuela, Apartado 50587, Caracas 1050, Venezuela**

"Twenty-eight children who received three doses of the quadrivalent rotavirus vaccine with  $4 \times 10^5$  plaque-forming units (p.f.u.) were followed during a year after vaccination. Serum samples were obtained and evaluated for rotavirus IgA and neutralizing antibodies against vaccine and human rotavirus strains. At the end of the study, up to 61% of the children showed an increase in circulating IgA antibody levels. Nearly all of the vaccinated children increased their neutralizing antibody titres against the vaccine strains, and 25-54% against human rotavirus serotypes. After comparing the vaccinees with a population of children naturally infected with serotype G1 in the same study area, we conclude that three doses of  $4 \times 10^5$  p.f.u. of the quadrivalent vaccine should prepare the child against future severe rotavirus diarrhea."

**2 2 5 Venkatesan P. Albendazole. *J Antimicrob Chemother* 1998 Feb;41(2):145-7. 28 ref, Eng. Department of Infection and Tropical Diseases, Birmingham Heartlands Hospital, Birmingham B9 5ST, UK**

**2 2 6 Wanke CA, Mayer H, Weber R, Zbinden R, Watson DA, Acheson D. Enteroparasitosis: *Escherichia coli* as a potential cause of diarrheal disease in adults infected with human immunodeficiency virus. *J Infect Dis* 1998 Jul;178(1):185-90. 30 ref, Eng. Division of Infectious Diseases, Beth Israel Deaconess Medical Center, One Deaconess Road, Boston, MA 02215, USA**

**2 2 7 Wapnir RA, Wingertzahn MA, Moyse J, Teichberg S. Proabsorptive effects of modified tapioca starch as an additive of oral rehydration solutions. *J Pediatr Gastroenterol Nutr* 1998 Jul;27(1):17-22. 34 ref, Eng. Department of Pediatrics, North Shore University Hospital, Manhasset, NY 11030, USA**

**"Background:** Partially hydrolyzed starches from staple cereals, obtained by heat or by enzymatic treatment, are often used in the formulation of homemade oral

extemporaneously used oral rehydration solutions used in developing countries. Conflicting or anecdotal results obtained thus far could be clarified with a standardized preparation tested under well-controlled laboratory conditions. **Methods:** A modified commercial tapioca starch was tested. Textra (National Starch and Chemical Co. Bridgewater, NJ, U.S.A.) added at 0, 5 or 10 g/l to an oral rehydration solution with 90 mM sodium and 111 mM glucose, in 30 rats malnourished by a protein-deficient diet for 3 weeks and in 26 well-fed control animals, using a one-pass jejunal perfusion. **Results:** In protein-deficient rats, Textra stimulated sodium absorption at 5 and 10 g/l (mean  $\pm$  SEM); 0 g/l Textra:  $160 \pm 13$  nmol/min  $\times$  cm; 5 g/l Textra:  $406 \pm 31$  ( $p < 0.0001$ ); and 10 g/l Textra  $230 \pm 27$  ( $p < 0.02$ ). Potassium absorption was comparably increased. Textra also improved net water absorption and the water influx:efflux ratio. Glucose absorption was increased only at 10 g/l Textra. In control rats, Textra improved sodium and net water absorption at 5 g/l, but not at 10 g/l Textra; but the influx:efflux ratio and potassium absorption were unaltered. **Conclusions:** These data, obtained in normal and protein-deficient rats, support the view that modified starch is a potentially useful, energy-rich additive for oral rehydration solution, which does not introduce an osmotic penalty.”

**2 2 8 Way SS, Goldberg MB. Clearance of *Shigella flexneri* infection occurs through a nitric oxide-independent mechanism (note). Infect Immun 1998 Jun; 66(6):3012-6. 33 ref, Eng.** Department of Microbiology and Immunology, Albert Einstein College of Medicine, 1300 Morris Park Ave., Bronx, NY 10461, USA

**2 2 9 Wershil BK, Castagliuolo I, Pothoulakis C. Direct evidence of mast cell involvement in *Clostridium difficile* toxin A-induced enteritis in mice. Gastroenterology 1998 May;114(5):956-64. 46 ref, Eng.** Combined Program in Pediatric Gastroenterology and Nutrition, Massachusetts General Hospital, 149, 13<sup>th</sup> Street, Charlestown, Massachusetts 02129, USA

**2 3 0 West BC, Silberman R, Otterson WN. Acalculous cholecystitis and septicemia caused by non-O1 *Vibrio cholerae*: first reported case and review of biliary infections with *Vibrio cholerae*. (case report) Diagn Microbiol Infect Dis 1998 Mar;30(3): 187-91. 31 ref, Eng.** Department of Medicine, Meridia Huron Hospital, 13951 Terrace Road, Cleveland, OH 44112, USA

“The first case of septicemic acute acalculous cholecystitis caused by non-O1 *Vibrio cholerae* is described in a healthy traveler, and biliary tract infections from *V. cholerae* are reviewed. Immediately after a vacation in Cancun, Mexico, a 55-year-old man developed acute cholecystitis. Blood and bile cultures grew non-O1 *V. cholerae*. At surgery, the gallbladder was acalculous, inflamed, distended, and nearly ruptured. Pathogenetic factors may have included diarrhea prophylaxis with bismuth subsalicylate, distension of the gallbladder from illness-induced fasting, and bacterial toxins in the gallbladder. The patient received i.v. cephalosporin, followed by oral cephradine for a total of 10 days, and he made a quick and complete recovery. *V. cholerae* should be considered in the differential diagnosis of persons from endemic areas who present with cholecystitis or acute jaundice.”

**2 3 1 Wilcox MH. *Clostridium difficile*—setting the scene. J Antimicrob Chemother 1998 May;41(Suppl C):1-3. 18 ref, Eng.** Department of Microbiology, University of Leeds and The General Infirmary, Leeds LS2 9JT, UK

**2 3 2 Wu Z, Nybom P, Sundqvist T, Magnusson K-E. Endogenous nitric oxide in MDCK-I cells modulates the *Vibrio cholerae* haemagglutinin/protease (HA/P)-mediated cytotoxicity. Microbial Pathogen 1998 May;24(5):321-6. 10 ref, Eng.** Department of Medical Microbiology, Linköping University, Faculty of Health Sciences, S-581 85, Linköping, Sweden

**2 3 3 Yu J. Inactivation of DsbA, but not DsbC and DsbD, affects the intracellular survival and virulence of *Shigella flexneri*. Infect Immun 1998 Aug;66(8):3909-17. 39 ref, Eng.** Molecular Infectious Diseases Group, Department of Paediatrics, Imperial College School of Medicine at St. Mary's, Norfolk Place, London W2 1PG, UK

“In this study, three mutants, *dsbA::kan*, *dsbC-kan*, and *dsbD-kan*, of *Shigella flexneri* serotype 5 were constructed and characterized to investigate the role of the periplasmic thiol:disulfid oxidoreductases in pathogenicity. In gentamicin protection assays and the Sereny test, the *dsbA* mutant showed reduced virulence while the *dsbC* and *dsbD* mutants were similar to the wild type. That inactivation of *dsbA* was responsible for the reduced virulence was verified by complementation with the cloned wild-type gene in in vitro and in vivo assays.



Despite the changed virulence behavior, the *dsbA* mutant could penetrate HeLa cells 15 min postinfection, consistent with the fact that it actively secretes Ipa proteins upon Congo red induction. Furthermore, the *dsbA* mutant was able to produce actin comets and protrusions, indicating its capacity for intra- and intercellular spread. However, a kinetic analysis of intracellular growth showed that the *dsbA* mutant barely grew in HeLa cells during a 4-h infection whereas the wild type had a doubling time of 41 min. Electron

microscopy analysis revealed that *dsbA* mutant bacteria were trapped in protrusion-derived vacuoles surrounded by double membranes, resembling an *icsB* mutant reported previously. Moreover, the trapped bacteria appeared to be lysed simultaneously with the double membranes, resulting in characteristic empty vacuoles in the host cell cytosol. Thus, the attenuation mechanism for *dsbA* mutant appears to be more complicated than was previously suggested.”

CONTENTS

**ORIGINAL PAPERS**

- 173 **The Effect of Two Child-care Practices of Market Women on Diarrhoea Prevalence, Feeding Patterns and Nutritional Status of Children Aged 0-24 Months.** Henrietta N Ene-Obong, Ada C Uwaegbute, Christian U Iroegbu, and Uche V Amazigo
- 180 **Serogroups and Antimicrobial Susceptibility of Clinical Isolates of *Salmonella* Species from a Teaching Hospital in Kuwait.** Wafaa Y Jamal, T Pal, VO Rotimi, and TD Chugh
- 187 **Difficulties in Conducting Participatory Action Research to Prevent Diarrhoea in a Slum Area of Bangkok.** Sungkom Jongpipitvanich, Suriya Veeravongs, and Wathana Wonsekiarttirat
- 194 **Diarrhoea in Children of Nigerian Market Women: Prevalence, Knowledge of Causes, and Management.** Folashade O Omokhodion, Adefunke Oyemade, Mynepalli kc Sridhar, Isaac O Olaseha, and Joshua F Olawuyi

**SHORT REPORT**

- 201 **An Outbreak of Food Poisoning Associated with Restaurant-made Mayonnaise in Abha, Saudi Arabia.** Khalid Saeed Al-Ahmadi, Hassan E El Bushra, and Ali Saeed Al-Zahrani

**BIBLIOGRAPHY ON DIARRHOEAL DISEASES**

- 205 Contents
- 207 Bibliography
- vi Author index
- ix Source index

**INFORMATION FOR CONTRIBUTORS**