

Studies on diarrhoeal illness among hospitalized children under 5 years of age in Baghdad during 1990–97

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دراسة أمراض الإسهال في الأطفال الذين تقل أعمارهم عن خمس سنوات في مستشفيات بغداد (1990–1997)
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الخلاصة: أجريت الدراسة الاستيعابية على جميع الأطفال الذين أدخلوا إلى مستشفيات تعليميين للأطفال في مدينة بغداد بسبب إصابتهم بالإسهال الحاد خلال الفترة (1990-1997). ومن بين جميع الأطفال الذين أدخلوا إلى ذئك المستشفيات كان إدخال 14.9% منهم بسبب الإسهال، وكان 55.5% من هؤلاء الأطفال دون السنة من العمر، وكانت قمة الحدوث في عمر يتراوح بين 3 و6 شهور، وكان الإسهال يميل للحدوث في أشهر الصيف، وقد تم استفراد عامل ممرض واحد فقط في 97% من الحالات، فقد استُفردت جرثيم الإشريكية القولونية الممرضة للأمعاء من 13% من المرضى، وهي أكثر الجراثيم التي استُفردت تواتراً. وكانت النسبة المئوية للموفيات المرافقة للإسهال 28.6%. إن المعطيات الموثقة حول تكرار الإسهال وأنماط حدوثه يؤكد الحاجة إلى تحسين الإجراءات التشخيصية والوقائية والعلاجية لمعالجة هذه الحالات المهددة للحياة.

ABSTRACT A retrospective study of all infants and children admitted to two paediatric teaching hospitals in Baghdad city complaining of acute diarrhoea during 1990–1997 was carried out. Of all children admitted, 14.9% were for diarrhoea, 55.5% of whom were under 1 year of age. The peak incidence was at 3–6 months and tended to be during the summer months. In 97% of cases only one pathogen was identified, enteropathogenic *Escherichia coli* being the most frequently isolated organism, isolated from 13% of the patients. The proportion of deaths associated with diarrhoea was 28.6%. The documented frequency and patterns of occurrence of diarrhoeal disease emphasize the need for improved diagnostic, preventive and therapeutic measures against this potentially life-threatening condition.

Etude des maladies diarrhéiques chez des enfants de moins de cinq ans hospitalisés à Bagdad durant la période 1990-1997

RESUME On a réalisé une étude rétrospective de tous les nourrissons et enfants admis pour diarrhée aiguë dans deux hôpitaux universitaires pédiatriques de la ville de Bagdad entre 1990 et 1997. Ceux-ci représentaient, parmi tous les enfants hospitalisés, 14,9 % des cas, dont 55,5 % étaient âgés de moins d'un an. Le pic d'incidence concernait les enfants de 3-6 mois et avait tendance à se produire durant les mois d'été. Dans 97 % des cas, un seul agent pathogène a été identifié, *Escherichia coli* entéropathogène étant l'organisme le plus fréquemment isolé chez 13 % des patients. La proportion de décès associés à la diarrhée était de 28,6 %. La fréquence documentée et les modes de survenue de la maladie diarrhéique soulignent la nécessité d'améliorer les mesures diagnostiques, préventives et thérapeutiques afin de lutter contre cette affection qui peut être parfois mortelle.

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Introduction

Diarrhoeal diseases represent a major public health problem in many areas of the world [1-3]. It is estimated that there are approximately 1.3 thousand million episodes and almost 5 million deaths in children younger than 5 years each year [4].

Iraq used to have an advanced system of health care. However, the situation has dramatically deteriorated since sanctions started in 1990. The hazards of inadequate water supply and sewage disposal are nationwide, and the effects on health are serious, such as increased prevalence of severe gastroenteritis [5].

Knowledge of the specific pathogens that cause diarrhoeal diseases and their epidemiology is critical for the implementation of specific intervention strategies. However, data on the etiology of diarrhoea in Iraq are scarce [6-8] and are not as detailed and comprehensive as they should be. In an attempt to fill the gap in the literature on diarrhoeal illness during the past 10 years, this report provides information of an eight-year (1990-97) retrospective study on the frequency of isolated enteropathogens from stools of children with diarrhoea.

Due to the improvements in the diagnostic techniques used in routine examination by the health authority laboratories during 1998, data for subsequent years will be reported in another paper.

Methods

Patients

All children and infants admitted to the paediatric teaching hospitals in Baghdad (Saddam Central Paediatric Hospital and Al-Mansour Paediatric Hospital) during 1990-97 with a history of diarrhoea of less than 7 days duration were included in this study. A

total of 132 373 children were admitted. There were 719 (3.6%) cases with a history of bloody diarrhoea.

Individual case records of these children were scrutinized. A special proforma was designed to collect information regarding epidemiological variables such as age, sex, month of admission; other information, such as the result of faecal cultures, was also included. Incomplete case records were excluded (4301 case records).

Records of patients who died and had more than one serious condition that was unrelated to diarrhoea were excluded (240).

Microbiology

Patient rectal swab specimens or stools were routinely analysed in the hospital. The faecal samples were sent to the laboratory within 2 hours of collection. The specimens were cultured on MacConkey agar and salmonella-shigella agar (BioMérieux, France).

The presence of enteropathogenic *Escherichia coli* was detected using specific antisera (Institut Pasteur Production). Traditional diagnostic techniques used in our routine examinations detect only a limited number of enteric pathogens; there were no facilities for detection of rotaviruses, for example.

Statistical analysis

The Student *t*-test was employed in the analysis of data; $P < 0.05$ was considered significant.

Results

Admission rate, age, incidence and mortality rate

Of 132 373 total admissions during 1990-97, 19 680 children (14.9%), had diarrhoea, and 10 936 (55.5%) of admitted

cases of diarrhoea were below 1 year of age. The peak incidence was 3–6 months (Figure 1). The male to female ratio was 1.6:1.0. There was no significant sex difference between various age groups ($P > 0.05$). Table 1 summarizes different mortality rates. The proportion of all deaths caused by diarrhoea was 28.6%.

Seasonal variation

The seasonal and monthly frequency of isolation of bacterial enteric pathogens did not differ substantially between the years of the study, therefore the data were combined for the whole period. Figure 2 shows that the majority of the cases occurred during May (12.9%).

A minor peak occurred during October (10.36%), while the fewest cases admitted were during January, February and March (6.14%, 5.55% and 5.55% respectively).

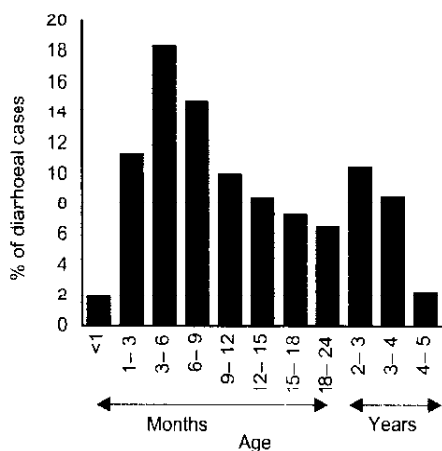


Figure 1 Distribution of diarrhoeal diseases in relation to age in infants under 5 years (data for Saddam Central Paediatric Teaching Hospital)

Table 1 Estimation of mortality rates in the studied children during the period 1990–1997^a

Rates	Value
Mortality rate	5.51‰
Diarrhoeal mortality	1.57‰
Proportion of deaths associated with diarrhoea	28.6%
Incidence rate of diarrhoea	7.1%

^aData are for Saddam Central Paediatric Hospital and were available only for 1992, 1995 and 1996.

Bacterial isolation

The stools of 4824 patients (< 5 years) with diarrhoea were examined during the study period, and bacterial pathogens were recovered from the stools of 1109 patients (22.9%). From these 1109 stool cultures,

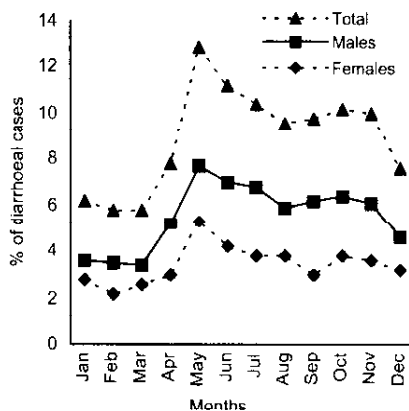


Figure 2 Monthly diarrhoeal cases among the children for the period 1990–97 (data for children under 1 year of age)

Table 2 Bacterial pathogens isolated from diarrhoeal patients during 1990–97

Variable	% of isolation
<i>Organism</i>	
Enteropathogenic <i>E. coli</i>	13
Salmonella	7
Shigella	3
<i>Single/multiple organism</i>	
Single	97
Multiple	3
<i>Bacterial isolation</i>	
Overall enteropathogen isolation in diarrhoeal cases	22.9
Cases of diarrhoea without bacterial isolation	77.1

1077 (97%) yielded a single enteric bacterial pathogen, whereas 3% of the isolates had multiple kinds. Enteropathogenic *E. coli* (EPEC) was the most frequent bacterial enteropathogens isolated from patients with diarrhoea. These organisms were isolated in 13% of patients. Salmonella and shigella were identified in 7% and 3% of patients respectively (Table 2).

Age-specific isolation rates are shown in Figure 3. Detection of EPEC peaked in the first 6 months of infancy (3–6 months), remained high in the second 6 months and started to fall in the second year of life. The patterns of isolation by age observed for salmonella and shigella were different (Figure 3).

Discussion

Admission rate

This study provided further evidence that diarrhoea is common and remains a major public health problem among children

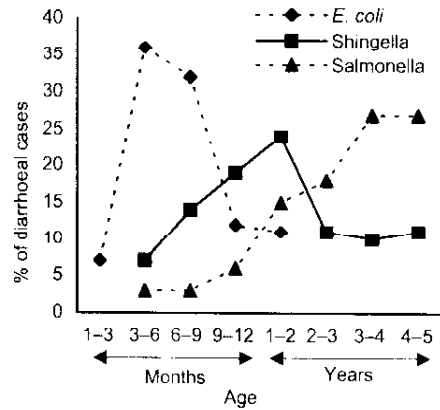


Figure 3 Age-specific isolation rates for enteropathogens in children with acute diarrhoea during the period 1990–1997 (data for children under 1 year of age)

under 5 years. We have attempted to provide information on the epidemiology and etiology of diarrhoea in children. Hospital figures in this study showed that more than 14% of admitted children under 5 years were suffering from diarrhoea; this represents a heavy load for a national health budget.

These results are consistent with other studies claiming approximately 18% of children admitted to a children's hospital were suffering from diarrhoea [8]. However, other studies have reported diarrhoea rates of about 70%, 78%, 69% and 50% in children admitted to Sulaimanyah Paediatric Hospital, Mosul Paediatric Hospital, Ramadi Paediatric Hospital and Erbil Paediatric Hospital respectively [9]. Such differences may, to some extent, be due to referral bias, and geographic and seasonal patterns.

Age incidence

This study was carried out in two large paediatric hospitals in Baghdad. These hospitals offered a unique opportunity to study age-specific distribution of diarrhoea. The age distribution of the admitted children showed that they were mostly infants (55.5%). Very high rates of acute diarrhoea in infants under 1 year of age are commonly observed in Iraq [8,10,11].

These data are also in keeping with those from neighbouring countries. Reports from Bahrain [12] and Saudi Arabia [13] showed that 50% and 43.4% respectively of their children hospitalized with gastroenteritis were below 1 year of age. Our results are also similar to those reported in China [14].

The age-specific differences suggest that infants as well as having an immature immune systems may be exposed to contaminated formula, foods or environment or may not be protected completely by breastfeeding. No local study is available concerning transplacental immunity to specific enteropathogens.

Some literature has shown that if *E. coli* is fed to pregnant women near term, cells producing IgA antibodies against the strain appear in the colostrum cells within 3 days [15]. Other studies for developing countries reported increased titres of antirotaviral and antienterotoxin antibodies in colostrum and breast milk samples [16].

Mata and Urrutia studied exclusively breastfed neonates in indigenous communities and made weekly faecal cultures [17]. They found that these infants did not yield positive bacterial cultures in the neonatal period, despite the fact that some 5% of the mothers were carriers of *E. coli*. The incidence of infection was 3.3% in the second 6 months of life. Children of the same ethnic community living in urban areas, fed artificially or given mixed food,

showed a higher incidence of *E. coli* infection.

Mortality rate

Most diarrhoeal episodes last only for a short time and clear up, but as many as 10% of children die from them before reaching their fifth year [15].

In Iraq, diarrhoea was reported to be responsible for about one out of four deaths among infants under 1 year old [8]. The mortality rate in our study in children under 5 years old was found to be very high (5.51 per 1000) (Table 1). Diarrhoea was one of the major causes since death was related to diarrhoea in about 28.6% of the cases. There are no similar local data on death rates from diarrhoea for comparison.

Seasonal variation

The results indicated that diarrhoeal illness occurred throughout the year, with marked seasonal patterns, May being the peak month (Figure 2).

The seasonal variation in the occurrence of infantile diarrhoea was studied previously by Makkia et al. in a study involving 2800 children under 2 years of age with acute diarrhoea referred to the Medical City in Baghdad [8]. The study showed that 44% of cases of diarrhoea occurred during summer and only 14% occurred in winter.

Bacterial Isolation and etiology of diarrhoea

EPEC is an important cause of diarrhoea in developing countries [15]. As regards the etiology of diarrhoea in the present study, the results shows 1109 cases (22.9%) out of a total of 4824 suffering from diarrhoea were due to bacterial infection. EPEC was the most frequently recovered bacterial agent in our study; the recovery rate of EPEC was 13%, which agrees with the

results of Makkia et al. [7] in Baghdad. However, in a recent study in Basra, Iraq, Hasony showed that enteropathogenic *E. coli* was found in 52% of examined specimens [18]. This may be due to the use of better methods for isolation and identification [15] or that pathogenic *E. coli* is an important etiological agent in infants with diarrhoea. This was reported previously by Mahmood and Feachem during the late 1980s in Basra [19]. In a more recent study in Baghdad, Obsidi and Delaimi reported that EPEC was isolated at a rate of 48% from 800 stool samples from children suffering from diarrhoea [20].

These results indicate that EPEC remains an important cause of diarrhoea in infants. These findings are also consistent with increasing recent awareness of these pathogens as causes of diarrhoeal illness in both tropical and semitropical areas [15]. In Brazil, EPEC was largely responsible for diarrhoea (25%–34%) in infants [16].

In contrast, reports from the Riyadh Armed Forces Hospital [21], the Diarrhoea Control Centre, Dammam in Saudi Arabia [13], the Defence Force Hospital in Bahrain [12] and an area of Crete [3] showed that the isolation rate of EPEC was low from the stools of children: 0.2%, 0.9%, 2% and 3.9% respectively. Such a low rates tend to be observed in countries with improving hygiene standards [15].

After EPEC, the common enteropathogens found were salmonella and shigella, with isolation rates of 7% and 3% respectively. Because of the lack of diagnostic methods, there was no way to identify most serotypes. The recovery rates reported in our study are similar to those reported by Qadri et al. (7% and 4.7%) [13].

Our results showed that shigella was isolated at higher rates from children under 1 year of age, and that there was an

increase in shigella isolation with increasing age up to one year of age (Figure 3).

Salmonella isolates are of animal origin and transmitted through their products, usually eggs, milk and meat. Therefore, infected infants might have acquired the bacteria from many possible sources, including their mothers and contaminated utensils. For older children, contaminated food is mostly to blame.

Our routine traditional diagnostic techniques are not enough to identify all agents important in causing diarrhoea. More techniques and better facilities are needed to identify the missed cases (77% cases of diarrhoea without bacterial isolation, Table 2), which could also be of significance and might have been caused by other pathogens, such as rotaviruses and *Campylobacter* spp. Moreover, the sample in the present study consisted of patients admitted to the paediatric hospital. This group represents only a small proportion of patients who developed diarrhoea during the study period. A large proportion would have been treated as outpatients.

Conclusions

- Infantile diarrhoea is common in children admitted to Baghdad hospitals.
- Among the enteropathogenic bacteria, *E. coli* was the enteric pathogen most frequently isolated from infants with diarrhoea.
- Mortality due to diarrhoea is high.

The documented frequency and patterns of occurrence of diarrhoea in both in the present and other Iraqi studies [8] emphasize the need for improved diagnostic techniques and preventive and therapeutic procedures to minimize these potentially life-threatening diseases.

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Integrated Management of Childhood Illness (IMCI)

Each year more than 10 million children in low-and middle-income countries die before they reach their fifth birthday. Seven in ten of these deaths are due to just five preventable and treatable conditions: pneumonia, diarrhoea, malaria, measles and malnutrition, and often to a combination of these conditions. Providing quality care to sick children is a serious challenge. WHO and UNICEF have addressed this challenge by developing a strategy called Integrated Management of Childhood Illness. IMCI aims to reduce death, illness and disability, and to promote improved growth and development among children under 5 years of age. IMCI is implemented by working with local governments and ministries of health to plan and adapt the principles of this approach to local circumstances. At the present time, the department is working on the following new areas within IMCI: recognition and care of children with HIV/AIDS, interactive care for healthy child development and neonatal health. Further information can be found at: <http://www.who.int/child-adolescent-health/integr.htm>