Epidemiology of diarrhoeal diseases among children under age 5 years in Dakahlia, Egypt

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وبائيات أمراض الإسهال بين الأطفال دون الخامسة من العمر في الدقهلية — مصر

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الخلاصة: وباستخدام عينة عنقودية متعددة المراحل، قمنا بإجراء مسح للأسر حول الإصابة بأمراض الإسهال، شمل 4458 طفلاً تحت سن الخامسة، في محافظة الدقهلية بمصر، وذلك خلال الفترة الواقعة بين حزيران/يونيو 2002 وأيار/مايو 2003، لتحديد معدل الانتشار ومحدِّدات أمراض الإسهال. ولقد وُجد أن معدل حدوث الإسهال في الأسبوعين السابقين للبحث وقبله بأربع وعشرين ساعة، كان 23.6٪ و8.7٪ على التوالي. وكان معدل استخدام محلول معالجة الجفاف عن طريق الفم 24.3٪ بين الأطفال الذين أصيبوا بالإسهال خلال الأسبوعين للذين سبقا إجراء البحث. وكان معدل حدوث الإسهال أعلى كثيراً بين أطفال المناطق الريفية، ممَّنْ تتراوح أعمارهم بين 6 و24 شهراً، وينتمون لعائلات كبيرة العدد، وخلال موسم الصيف، وأطفال الأمهات الأصغر سناً، والأقل تعليماً أو غير العاملات، وأطفال الآباء الأقل تعليماً، أو الذين يعملون كمزارعين أو يمارسون أعمالاً يدوية. كما كانت هناك علاقة واضحة بين الإصابة بأمراض الإسهال وبين العوامل المتمثلة في المنازل المزدحمة، والتخلص غير الصحي للنفايات، والمراحيض غير الطاردة للنفايات.

ABSTRACT Using multistage cluster sampling, we conducted a household survey of diarrhoea among 4458 children under age 5 years in Dakahlia governorate from June 2002 to May 2003 to determine the prevalence and determinants of diarrhoeal diseases. Frequency of diarrhoea in the previous 2 weeks and last 24 hours were 23.6% and 8.7% respectively. Oral rehydration solution use rate was 24.3% among children with diarrhoea in the past 2 weeks. The frequency of diarrhoea was significantly higher among children in rural areas, those aged 6–24 months and of higher birth order, in the summer, when mothers were younger, had lower education or were not working, and when fathers had lower education or were farmers or manual labourers. Overcrowding, improper refuse disposal and non-flush toilets were also significantly correlated with diarrhoea incidence.

Épidémiologie des maladies diarrhéiques chez les enfants de moins de 5 ans à Dakahlia (Égypte)
RÉSUMÉ À l'aide d'un sondage en grappes à plusieurs degrés, nous avons réalisé une enquête dans les ménages sur la diarrhée chez 4458 enfants de moins de 5 ans dans le gouvernorat de Dakahlia entre juin 2002 et mai 2003 afin de déterminer la prévalence des maladies diarrhéiques et d'identifier leurs déterminants. La fréquence de la diarrhée au cours des 2 semaines précédentes et des dernières 24 heures était respectivement de 23,6 % et 8,7 %. Le taux d'utilisation de la solution de réhydratation orale était de 24,3 % chez les enfants souffrant de diarrhée au cours des 2 semaines précédentes. La fréquence de la diarrhée était significativement plus élevée chez les enfants vivant en zone rurale, chez ceux âgés de 6 à 24 mois et de rang de naissance plus élevé, pendant la saison d'été, lorsque la mère était plus jeune, peu instruite ou ne travaillait pas, et lorsque le père était peu instruit ou était agriculteur ou manœuvre. Le surpeuplement, l'élimination inappropriée des ordures et des toilettes sans chasse d'eau étaient significativement corrélés à l'incidence de la diarrhée.

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Introduction

Diarrhoea is a leading cause of illness and death among children under 5 years of age in developing countries [*1,2*]. Many factors, including sociodemographic, environmental and housing characteristics, affect the prevalence of diarrhoea.

In Egypt, the widespread use of oral rehydration therapy has successfully lessened the severity of diarrhoeal episodes and sharply reduced the number of subsequent deaths, but the incidence of diarrhoeal diseases has not declined [*3,4*]. This indicates that the causative agents of diarrhoea and their environmental sources are still with us. On average, children under 3 years of age suffer 3 bouts of acute diarrhoea per year [*3,4*].

Acute diarrhoea of all etiologies can be safely treated with oral rehydration solution (ORS). The routine use of antibiotics and anti-parasitic medicines should be avoided. Antidiarrhoeal drugs should never be used as none has proven practical and some are dangerous [*5,6*]. When a breastfed child has diarrhoea, continued breastfeeding is important [*7*].

Information on morbidity and treatment of diarrhoea can be obtained from the reports of the various health facilities. Nonetheless, cases seen at these health facilities may represent only a fraction of the actual cases occurring in the community since many cases may be treated at home or may recover without treatment. Even if a high proportion of cases is seen at the health facilities, reporting is likely to be incomplete. Therefore, we conducted a household survey to measure the magnitude of the problem.

The aim of our study was to collect current and reliable information on the prevalence and determinants of diarrhoeal diseases among children under 5 years of age in Dakahlia governorate, Egypt. To do this, we measured period (last 2 weeks) and point (last 24 hours) prevalence rates of diarrhoeal diseases among children and evaluated the association of these diseases with sociodemographic, environmental and housing characteristics. Both rates were measured as recommended by the Word Health Organization and in order to allow comparison with other studies. We also gathered information about the treatment of diarrhoeal episodes, especially the use of ORS and its determinants.

Methods

Dakahlia governorate is in the north-eastern Nile Delta and is inhabited by more than 4 million people. According to the Statistical Department of the Health Directorate of Dakahlia (2001), about 12% of the population were children under 5 years of age.

In 2002, the Egypt Demographic and Health Survey reported that among children aged under 5 years, 13.4% had had diarrhoea in the last 2 weeks [*8*]. We aimed to be within 0.01 of the actual proportion and therefore set our target sample at approximately 4458 children under 5 years of age (1 month to less than 60 months of age), or 5% probability of significance. We calculated sample size as [*9*]:

$$n = P(1 - P)(Z_a)^2/(d)^2$$

where n was the required sample size, P was the proportion of interest, Z_a was 1.96 and d was the distance, or how close we required our estimate to be to the proportion of interest.

Data were collected from 1 June 2002 to 31 May 2003, i.e. over the course of a year to sample all 4 seasons.

A multistage random sample of the target children was chosen. Three districts (Mansoura, Mitghamr and Dekernis) were

selected randomly from the 12 districts of the governorate and an urban sector and 2 rural villages were randomly chosen from each of these 3 districts. We selected our sample with the cluster sampling technique. A total of 100 clusters were used (25 clusters per season) and each cluster comprised 40–50 children less than 5 years of age. The sample was distributed among the urban and the rural areas of the chosen districts in proportion to the population size. In each cluster, the starting house was randomly selected. We replaced empty houses and non-participating families (7 families) with the neighbouring house.

We designed and pre-tested 2 questionnaire forms. The first form was completed for every child less than 5 years of age and covered data related to the child as well as sociodemographic characteristics of the parents and the housing conditions. The social score of each family was calculated as per Fahmy and El-Sherbini [*10*]. This scoring system encompassed the education and occupation of the parents, income, family size and housing conditions. The second form was completed for every target child who had had at least one episode of diarrhoea within the past 2 weeks, and recorded details of the diarrhoea and treatment practices. Diarrhoea was defined as the passing of liquid or watery stools at least 3 times in one day [*5*]. Accompanied by a nurse from the local health facility, we visited and interviewed the families. Observer bias was considered to be minimal as both researchers were experienced in such data collection. As regards recall bias for medication, the family member was requested to show any prescriptions, the drug itself, or the container

Data were analysed using *Epi-Info*, version 6.02. The chi-squared test was used to test the difference between groups. Statistical significance was set at $P \leq 0.05$.

Results

The period (last 2 weeks) and the point (24 hours) prevalence rates of diarrhoeal diseases among children under age 5 years were 23.6% and 8.7% respectively (Table 1). Both rates were significantly higher

Table 1 **Overall prevalence of diarrhoeal diseases and its variation according to residence and season**

Variable	Total		Diarrhoea during the last: 2 weeks		24 hours	
	No.	%	No.	%	No.	%
Overall	4458	100	1052	23.6	390	8.7
Residence						
Urban	1471	33.0	307	20.9**	96	6.5***
Rural	2987	67.0	745	25.0	294	9.8
Season						
Winter	858	19.2	120	14.0***	49	5.7***
Spring	805	18.1	199	24.7	76	9.4
Summer	1527	34.3	464	30.4	166	10.9
Autumn	1268	28.4	269	21.2	99	7.8

******P ≤ ***0.01;*** *******P ≤ ***0.001.***

among rural than among urban children and in the summer than in the other seasons.

Both period and point prevalence rates of diarrhoea decreased significantly with increased age apart from the first 6 months of age. These rates were highest in the age group of 6 months to less than 12 months and were lowest among children aged 48 months to less than 60 months. Both rates were significantly higher among higher birth order children compared with lower birth order children. However, the sex of the child had no significant effect on both prevalence rates of diarrhoea and among children under 24 months of age, breastfeeding had no significant effect either (Table 2).

Parents' education had a strong correlation with diarrhoeal diseases (Table 3). Both period and point prevalence rates were significantly lower among children of higher educated parents compared with those of less educated parents. Both rates were also significantly higher among children of mothers who did not go out to work and whose fathers were farmers compared with those who were professionals or semi-professionals. In addition, both rates were significantly higher among children whose mothers were less than 25

Table 2 **Prevalence of diarrhoeal diseases according to children's characteristics**

Variable	Total		Diarrhoea during the last: 2 weeks		24 hours	
	No.	%	No.	%	No.	%
Overall	4458	100	1052	23.6	390	8.7
Age (months)						
< 6	954	21.4	237	24.8***	99	10.4***
6–< 12	560	12.6	226	40.4	104	18.6
12–< 24	655	14.7	213	32.5	72	11.0
24–< 36	568	12.7	153	26.9	61	10.7
36–< 48	712	16.0	114	16.0	33	4.6
48–< 60	1009	22.9	109	10.8	21	2.1
Sex						
Male	2295	51.5	567	24.7	209	9.1
Female	2163	48.5	485	22.4	181	8.4
Birth order						
First	1539	34.5	374	24.3*	146	9.5*
Second and third	2052	46.0	447	21.8	154	7.5
Fourth and fifth	667	15.0	170	25.5	64	9.6
Sixth or higher	200	4.5	61	30.5	26	13.0
Currently breastfeeding[a]						
Yes	1614	74.4	488	30.2	199	12.3
No	555	25.6	188	33.9	76	13.7

P** ≤ ***0.05; ****P* ≤ ***0.001.

[a]***Includes children < 24 months of age only (***n ***= 2169).***

Table 3 **Prevalence of diarrhoeal diseases according to parents' characteristics**

Variable	Total		Diarrhoea during the last: 2 weeks		24 hours	
	No.	%	No.	%	No.	%
Overall	4458	100	1052	23.6	390	8.7
Maternal age (years)[a]						
< 25	1651	37.1	471	28.5***	170	10.3*
25–< 35	2357	52.9	486	20.6	185	7.8
35+	445	10.0	95	21.3	35	7.9
Maternal education[a]						
No schooling	2471	55.5	699	28.3***	257	10.4***
Primary/middle school	537	12.0	109	20.3	36	6.7
Secondary school and higher	1445	32.5	244	16.9	97	6.7
Maternal employment[a]						
Working outside the house	733	16.5	122	16.6***	41	5.6***
Housewife	3720	83.5	930	25.0	349	9.4
Father's age (years)[b]						
< 25	169	3.8	46	27.2	16	9.5
25–< 35	2574	57.8	632	24.6	236	9.2
35+	1707	38.4	372	21.8	138	8.1
Father's education[b]						
No schooling	2299	51.7	637	27.7***	231	10.0***
Primary/middle school	685	15.4	156	22.8	63	9.2
Secondary or higher	1466	32.9	257	17.5	96	6.5
Father's employment[b]						
Professional or semi-professional	1177	26.5	190	16.1***	76	6.5**
Farmer	607	13.6	166	27.3	64	10.5
Manual labourer	2095	47.1	564	26.9	203	9.7
Other[c]	571	12.8	130	22.8	47	8.2

***P ≤ 0.05; **P≤ 0.01**; ***P ≤ 0.001.**

[a]***5 mothers were dead.***

[b]***8 fathers were dead and 2 of their children had diarrhoea in the last 2 weeks.***

[c]***Tradesmen, members of the armed forces, unemployed, etc.***

years old, although the father's age was not significant.

Period and point prevalence rates of diarrhoea were not significantly related to floor type or water source (Table 4). Both rates were significantly higher for children in homes with high crowding indices, improper refuse disposal (in front of or away from the house), non-flush toilets and no available television or radio. Both rates were significantly higher among children whose families used kerosene or biomass as fuel (Table 4).

Table 5 shows that both period and point prevalence rates of diarrhoea were significantly higher among children from

Table 4 **Prevalence of diarrhoeal diseases according to housing conditions**

Variable	Total		Diarrhoea during the last: 2 weeks		24 hours	
	No.	%	No.	%	No.	%
Overall	4458	100	1052	23.6	390	8.7
Floor						
Earth	2480	55.6	609	24.8	226	9.1
Cement/tile	1978	44.4	443	22.4	164	8.3
Crowding index						
< 3	3957	88.8	882	22.3***	317	8.0***
3 or more	501	11.2	170	33.9	73	14.6
Water source						
Piped water	3468	77.8	813	23.4	296	8.5
Hand pump	990	22.2	239	24.1	94	9.5
Refuse disposal						
Municipal collection	679	15.2	126	18.6***	46	6.8***
In front of house	879	19.7	247	28.1	111	12.6
Away from house	2900	65.1	679	23.4	233	8.0
Toilet						
Flush	905	20.3	114	12.6***	41	4.5***
Non-flush	3553	79.7	938	26.4	349	9.8
Fuel for cooking						
Bottled gas	3807	85.4	838	22.0***	293	7.7***
Kerosene	599	13.4	193	32.2	90	15.0
Biomass	52	1.2	21	40.4	7	13.5
Television or radio						
Present	3741	83.9	821	21.9***	295	7.9***
Absent	717	16.1	231	32.2	95	13.2

***$P \leq 0.001$.

large families, those of low income or of low or very low social scores.

Among children with diarrhoea during the past 2 weeks, the ORS use rate was 24.3%; 71.0% received increased amounts of fluids and 74.7% were given drugs (Table 6). ORS use rate was significantly higher among children of rural residence, of younger age, and those with older mothers and less educated mothers (Table 7).

Of the 1052 children with diarrhoea in the last 2 weeks, 786 (74.7%) were given medicines other than ORS. Antidiarrhoeals and antibiotics were the most frequently used drugs (Table 8) and were usually prescribed by private doctors or parents while ORS was usually prescribed by public sector doctors (Table 9).

Discussion

Diarrhoeal diseases rank with acute respiratory infections as among the major caus-

Table 5 **Prevalence of diarrhoeal diseases according to family size, income and social score**

Variable	Total		Diarrhoea during the last: 2 weeks		24 hours	
	No.	%	No.	%	No.	%
Overall	4458	100	1052	23.6	390	8.7
Family size						
< 5 people	2573	57.7	574	22.3**	201	7.8*
5–6 people	1434	32.2	347	24.2	138	9.6
7 or more people	451	10.1	131	29.0	51	11.3
Income per capita/month[a] (Egyptian pounds)[b]						
< 50	1618	37.9	451	27.9***	165	10.2***
50–99	1949	45.7	462	23.2	181	9.3
100–149	416	9.7	69	16.6	24	5.8
< 150	284	6.7	21	7.4	8	2.8
Social score						
Very low	1002	22.5	301	30.0***	123	12.3***
Low	1741	39.0	481	27.6	163	9.4
Middle	1307	29.3	231	17.7	93	7.1
High	408	9.2	39	9.6	11	2.7

***P ≤ 0.05; **P≤ 0.01; ***P ≤ 0.001.**
[a]For 191 children, the family income was unknown.
[b]US$ 1 = 6 Egyptian pounds at the time of the study.

es of morbidity and mortality among children under 5 years of age [*11*]. The World Health Organization started the Diarrhoeal Disease Control Programme (DDCP) in 1980 with the objective to decrease diarrhoeal mortality and morbidity among young children in developing countries. In their estimate of the global burden of diarrhoeal diseases, Kosek et al. found that despite improving trends in mortality rates, there was no concurrent decrease in morbidity rates attributed to diarrhoea [*11*]. Persistent high rates of morbidity are of concern because early childhood diarrhoea may have long-term effects on linear growth and physical and cognitive function [*12–14*].

Table 6 **Treatment practices among 1052 children with diarrhoea in the last 2 weeks**

Treatment[a]	No.	%
Increased intake of fluids	747	71.0
Continued feeding	918	87.3
Oral rehydration solution	256	24.3
Drugs	786	74.7
Care sought outside the home	622	59.1

[a]Treatments were not mutually exclusive.

The National Diarrhoeal Disease Control Programme (NDDCP) of Egypt began in 1981 and became fully operational by 1984. Its principal strategy was to improve case-management of diarrhoea through rehydration and better feeding, by educating

Table 7 **Oral rehydration solution (ORS) use and its determinants in diarrhoea occurring during the past 2 weeks**

Variable	Total diarrhoeal cases		ORS use	
	No.	%	No.	%
Overall	1052	100.0	256	24.3
Residence				
Urban	307	29.2	58	18.9**
Rural	745	70.8	198	26.6
Mother's age (years)				
< 25	471	44.8	98	20.9*
25–34	486	46.2	130	26.7
35 or more	95	9.0	28	29.5
Mother's education				
No schooling	699	66.4	188	26.9*
Primary/middle school	109	10.4	23	21.1
Secondary and higher	244	23.2	45	18.4
Mother's employment				
Working outside the home	122	11.6	22	18.0
Housewife	930	88.4	234	25.2
Child's age (months)				
< 6	237	22.5	35	14.8***
6–11	226	21.8	109	48.2
12–23	213	20.2	71	33.3
24–35	153	14.5	31	20.3
36–47	114	10.8	10	8.8
48–<60	109	10.4	0	0.0
Child's sex				
Male	567	53.9	144	25.4
Female	485	46.1	112	23.1
Birth order				
First	374	35.6	89	23.8
Second or third	447	42.5	108	24.2
Fourth or fifth	170	16.2	43	25.3
Sixth or higher	61	5.8	16	26.2

P** ≤ ***0.05; ****P* ≤ ***0.01; *****P* ≤ ***0.001.

families through the mass media and by training health workers. It has been one of the most successful national oral rehydration programmes in decreasing child mortality due to diarrhoea [*15,16*]. Nonetheless, diarrhoeal diseases remain the leading cause of morbidity among infants and young children in Egypt.

In our study, 23.6% of children under 5 years of age were reported to have had di-

Table 8 **Frequency and type of drugs used in the 1052 children with diarrhoea**

Drug type[a]	No. of children given drugs (*n* = 786)	%
Antibiotics	290	36.9
Antidiarrhoeals	581	73.9
Antiemetics	131	16.7
Antiprotozoal	45	5.7
Antipyretics	107	9.6
Antispasmodics	13	1.7
Unidentified	146	18.6

[a]***Drugs used were not mutually exclusive.***

arrhoea in the 2 weeks preceding the survey (period prevalence rate) and 8.7% were reported to have had diarrhoea in the 24 hours preceding the survey (point prevalence rate). In 1985, the point prevalence of diarrhoea among children under 3 years of age in Dakahlia (our locality) was 28.2%, whereas it was 15.2% in Giza and 16.2% in Alexandria [*17*]. In a survey in Cairo and in 8 other governorates, the prevalence of diarrhoea in the previous week was 35% and 43% respectively [*18*]. In 1991, the 2-week period prevalence of diarrhoea in rural Menoufia was 26.2% [*19*]. During the winter season of 1993, the 2-week period prevalence was 14.3% and the point prevalence of diarrhoea was 5.6% [*8*]. In 1994, the 2-week and point prevalence rates in Dakahlia were 19% and 2.2% respectively [*20*]. These figures indicate no specific trend. Differences in the prevalence estimates of diarrhoea in the studies might be due to differences in recall abilities of mothers, differences in mothers' perceptions of diarrhoea, and differences in methodology and times at which the studies were carried out.

In our study, both period and point prevalence rates were significantly higher among rural children than among urban children. This may be attributed to better housing facilities and environmental conditions in urban areas [*20–22*]. In Jordan, a neighbouring country, however, the prevalence of diarrhoea with residence was not significant [*23*].

Mother's age, but not father's age, was significantly correlated with diarrhoea morbidity. Diarrhoea was more likely to occur among children of younger mothers (< 25

Table 9 **Prescriber of oral rehydrant solution (ORS) and drugs**

Prescriber	ORS (*n* = 256)		Drugs (*n* = 786)	
	No.	%	No.	%
Public sector doctor	109	42.6	122	15.5
Private sector doctor	104	40.6	410	52.2
Parent	31	12.1	189	24.0
Pharmacist	9	3.5	54	6.9
Other[a]	3	1.2	11	1.4

[a]***Includes nurses, other relatives, barbers or traditional healers.***

years), perhaps because of their inexperience with childcare. Father's age may have been less important because they were less likely to be involved in childcare. The Sinai Consultation Group reported similar findings, but in other developing countries, Zaire and Nigeria, this was not the case [*21,24,25*].

Childhood diarrhoea morbidity decreased significantly with higher educational levels of the parents. Better-educated mothers tended to marry similarly advantaged men with higher education and to enjoy a relatively higher standard of living. Also, education was reflected in child rearing and child health care practices during illness. Educated parents married later, delayed the onset of childbearing and had fewer children than less educated parents. Similar associations have been previously reported from Egypt and Zaire, although this was not true for Saudi Arabia or Nigeria [*8,22,24,25*].

Diarrhoea morbidity was significantly lower among children of mothers who worked outside the home and professional or semi-professional fathers. Other studies have varied on this point [*8,21,22,25,26*]. Higher prevalence of diarrhoea among children of mothers who did not work outside the home may be explained by their lower educational attainment. It may also be that these mothers observe their children more closely and worry more about their health status than other caretakers and that they therefore report more diarrhoea [*26*].

Apart from the first 6 months of life when maternally acquired immunity and breastfeeding without supplementation played a protective role, diarrhoea morbidity decreased significantly with the increase of the child's age. The prevalence of diarrhoea was highest at 6–< 12 months (the age when weaning began) and declined thereafter. This might be the result of the decline in maternally acquired antibodies and the introduction of weaning foods that are potentially contaminated. In addition, crawling usually begins at this age and the risk of ingesting contaminated materials is high, especially in unhygienic environments [*18,21,24,25*].

No significant sex difference in the prevalence of diarrhoea was observed. Boys and girls were probably equally exposed as the risk factors associated with diarrhoea are environmental and sociodemographic, rather than biological [*8,18, 19,25*].

First-born children and children with birth order of 4 or higher were more likely to have diarrhoea than others. With the first-born child, maternal experience in childcare might be lacking. With higher birth order children, the distribution of maternal attention and care to a large number of children may consequently mean more exposure to enteropathogens [*8,22*].

Among children under 2 years of age, breastfeeding had no significant effect on the prevalence of diarrhoea, probably due to the introduction of water and supplements along with the breast milk. These supplements increase the risk of diarrhoea, particularly in unhygienic environments [*27,28*]. Most studies have found that breastfeeding protects against diarrhoea [*29,30*]. In infants under 1 year of age, breast milk has been associated with a lower incidence of rotavirus diarrhoea [*31*].

Children from large families were more likely to have diarrhoea. Again this may be as a result of a greater chance of contact with enteric pathogens, of less attention given to children or of a deterioration in hygiene with large family size, although some have reported no association between family size and diarrhoea morbidity [*28*].

Low income was associated with high prevalence of childhood diarrhoea in our

study and others [*30,32*], but not all [*25*]. In our study, socioeconomic standard and diarrhoea morbidity were inversely associated. In families of high social status, both parents tended to be highly educated and to work as professionals or semi-professionals, with high income and small family size. These characteristics were reflected in better hygiene, child rearing and childcare. Our finding was in agreement with others [*33*].

Diarrhoea was more prevalent during the summer months, probably because hot weather encourages the growth of pathogenic organisms in contaminated food. Summer is also the breeding season for flies that act as mechanical vectors conveying enteropathogens to food and water [*4*].

Children living in unsanitary households were the primary victims of diarrhoea in our study and others [*21,26,34*]. Diarrhoea was encountered more often among children in homes where refuse was disposed of in front of the house and flush toilets were absent. These conditions provide breeding sites for flies and other insects that convey enteropathogens from refuse to food and water. The use of refuse collectors usually reflects high standards of living. The use of kerosene and biomass as a fuel source was also associated with a higher prevalence of diarrhoea, again reflecting low socioeconomic status. The presence of television or radio in the home was associated with a low prevalence of diarrhoea, probably because they disseminate health messages to households. In agreement with a previous study in rural Egypt, diarrhoea was independent of the source of water supply to homes [*35*]. Availability of piped water does not necessarily mean its uninterrupted flow and the potential cleanliness of the piped water source does not ensure water safety at the time of consumption if it is improperly stored or handled. Other researchers have, however, reported an association between diarrhoea and water source [*21,25*]. Previous studies have not found an association between the flooring in the home (whether earth or cement/tile) and diarrhoea [*22,25,35*].

Oral rehydration treatment, including rehydration and maintenance fluids with ORS, was the most beneficial treatment. Treatment with ORS is simple and facilitates the management of uncomplicated cases of diarrhoea of any etiologic agent at home [*36*]. Our study showed that 71.0% of diarrhoea cases during the previous 2 weeks had received increased fluids and 87.3% of them had continued feeding. These results were similar to NCDDP and National Acute Respiratory Infections Programme reports from Dakahlia during 1994 [*20*]. The high rates of use may be due to intensive communication, training activities and public education. In the past 2 weeks, approximately one-quarter of the children with diarrhoea had received ORS and three-quarters had received drugs. Drugs were more likely to be prescribed by private rather than public sector doctors. ORS use is standard policy in the public health system, whereas in the private sector its use is more open to the physician's choice. These results are similar to other studies of diarrhoea in Egypt [*16,20,37*]. The barriers to ORS use for diarrhoeal disease include cultural practices, lack of parental knowledge and lack of training of health professionals [*36*]. Antibiotics and antidiarrhoeal drugs were the most frequently prescribed drugs (73.9% and 36.9% respectively). Even these figures may be underestimated since 18.8% of diarrhoea cases were given unidentified drugs. These drugs may be used frequently because mothers and physicians may be more interested in treat-

ments that will rapidly stop diarrhoea, i.e. symptomatic treatment. Data from a longitudinal household survey in 1990–1991 in rural Egypt indicated substantial increases in both knowledge and use of ORS during the 1980s, although the same data showed that treatment of acute diarrhoeal episodes was far from optimal [*16*]. In particular, the use of oral rehydration was far from universal, the prescription of antibiotics was still too frequent, and antidiarrhoeal drugs of no therapeutic value were still widely used [*16*]. Because viruses are the predominant cause of acute diarrhoea in developing countries, the routine use of antidiarrhoeal agents for treating diarrhoea wastes resources and may lead to increased antimicrobial resistance [*38*]. Nonspecific antidiarrhoeal agents, antimotility agents, antisecretory drugs and toxin binders do not address the underlying causes of childhood diarrhoea and should not be used [*36*]. The message of ORS has penetrated into the general population, but the practices of health professionals have not changed [*37*].

The analysis of factors associated with ORS use showed that children of rural residence, of older mothers, of less educated mothers and those aged 6–11 months were more likely to receive ORS during diarrhoeal episodes. The treatment received was strongly influenced by the source of care. Rural and less educated mothers were more likely to consult public health facilities that were more likely to prescribe ORS. Children aged 6–23 months and those from poor households were more likely to receive ORS, but mothers' education had no consistent effect [*16*].

Childhood diarrhoea remains a public health problem in Dakahlia. Despite great efforts to educate the public and to train health personnel, treatment practices are still far from optimal and there is room for improvement. Health workers, especially in the private sector, must be trained in correct case management. Paediatric forms of symptomatic antidiarrhoeal drugs should be withdrawn from the market. Improvement of environmental sanitation and home hygiene and raising the socioeconomic status of the population will contribute to the elimination of the underlying causes of diarrhoea. Because this is beyond the limited resources of the Ministry of Health and Population, these activities should be an integral part of national development plans.

References

1. ***The management of diarrhoea and use of oral rehydration therapy – A joint WHO/UNICEF Statement***, 2nd ed. Geneva, World Health Organization, 1985:6.
2. Barahona F et al. ***Epidemiology and family health survey, Honduras, 1987: final report***. Tegucigalpa, Honduras, Honduran Ministry of Public Health, Association For Family Planning in Honduras, Management Sciences for Health, and Family Health International, 1989:140.
3. ***Control of diarrhoeal diseases***, 1st ed. Cairo, United Nations Children's Fund, 1990:17–8.
4. ***Control of diarrhoeal diseases in practice: a manual for health workers***, 2nd ed. Cairo, Egypt, Ministry of Health and Population, World Health Organization and United Nations Children's Fund, 1991.
5. ***A manual for the treatment of diarrhoea***. Geneva, World Health Organization

Programme for the Control of Diarrhoeal Diseases, 1990 (WHO/CDD/SER 80.2 Rev 2.):3.

6. World Health Organization, Division of Diarrhoeal and Acute Respiratory Disease Control. Rational management of diarrhoea in children. ***Essential drugs monitor***, 1991, (11):10–1.

7. ***Facts for life***. New York, United Nations Children's Fund, World Health Organization and United Nations Educational, Scientific and Cultural Organization, 1989:41.

8. El-Zanaty FH et al. Childhood illness and treatment. In: ***Egypt demographic and health survey***. Calverton, Maryland, USA, Egypt National Population Council and Macro International Inc., 2002:141–7.

9. Higgins JE, Shulman HB. Determining sample size. In: Wingo PA et al., eds. ***An epidemiologic approach to reproductive health***. Geneva, World Health Organization, Centre for Disease Control and Family Health International, 1991 (WHO/HRP/EPI/1994):154–71.

10. Fahmy SI, El-Sherbini AF. Determining simple parameters for social classifications for health research. ***Bulletin of the High Institute of Public Health***, 1983, 13(5):95–108.

11. Kosek M, Bern C, Guerrant R. The global burden of diarrhoeal diseases as estimated from studies published between 1992–2000. ***Bulletin of the World Health Organization***, 2003, 8(3):197–204.

12. Molbak K et al. Persistent and acute diarrhoea as the leading causes of child mortality in urban Guinea-Bissau. ***Transactions of the Royal Society of Tropical Medicine and Hygiene***, 1992, 86:216–20.

13. Jinadu MK et al. Childhood diarrhoea in rural Nigeria. I – Studies on prevalence, mortality and socio-environmental factors. ***Journal of diarrhoeal diseases research***, 1991, 9:323–7.

14. Pison G et al. Rapid decline in child mortality in a rural area of Senegal. ***International journal of epidemiology***, 1993, 22:72–80.

15. Miller P, Hirschhorn N. The effect of a national control of diarrheal diseases program on mortality: the case of Egypt. ***Social science and medicine***, 1995, 40(10):S1–S30.

16. Langsten R, Hill K. Treatment of childhood diarrhea in rural Egypt. ***Social science and medicine***, 1995, 40(10): 989–1001.

17. Nasser SS et al. Clinical classification of diarrheal diseases of children in Egypt. ***Diarrhea control newsletter***, 1985, 4:20–1.

18. El-Rafie M, Hassouna WA. Recent morbidity and mortality statistics related to diarrhea in Egypt (1984–1985). ***Diarrhea control newsletter***, 1986, 5:3–5.

19. Langsten R, Hill K. ***Child survival in rural Egypt: third 6 months report, September 1990–February 1991, final draft***. Cairo, Egypt Ministry of Health and Population, National Control of Diarrheal Diseases Project, 1991:18–24.

20. National Control of Diarrheal Diseases Project and National Acute Respiratory Infections Programme. ***Report on the combined control of diarrhoeal diseases and acute respiratory infections household survey (CCDD/AR1) household survey***. Cairo, Ministry of Health and Population, Primary Health Care Sector in collaboration with the World Health Organization and United Nations Children's Fund, 1994.

21. Sinai Consultation Group. ***Incidence of diarrhoea-associated illness in children aged 2 years and under in eight Egyptian governorates***. Cairo, Ministry of

Health and Population, National Control of Diarrheal Diseases Project, 1987:49–65.

22. Al-Mazrou YY, Farid S. Diarrhea morbidity. In: ***Saudi Arabian child health survey***. Riyadh, Ministry of Health, 1992:63–88.

23. Zou'bi AA, Poedjastoeti S, Ayad M. Childhood morbidity and treatment. In: ***Jordan population and family health survey, 1990***. Columbia, Maryland, USA, IRD/Macro International Inc, 1992:97–101.

24. Oni GA, Schumann DA, Oke EA. Diarrhoeal disease morbidity, risk factors and treatment in a low socioeconomic area of Ilorin, Kwara State, Nigeria. ***Journal of diarrhoeal diseases research***, 1991, 9(3):250–7.

25. Manun'ebo MN et al. Influence of demographic, socioeconomic and environmental variables on childhood diarrhoea in a rural area of Zaire. ***Journal of tropical medicine and hygiene***, 1994, 97:31–8.

26. Ekanem EE, Akitoye CO, Adedeye OT. Food hygiene behaviour and childhood diarrhoea in Lagos, Nigeria: a case control study. ***Journal of diarrhoeal diseases research***, 1991, 9(3):219–26.

27. Mock NB et al. Socioeconomic, environmental, demographic and behavioral factors associated with occurrence of diarrhea. ***Social science and medicine***, 1993, 36(6):807–16.

28. Knight SA et al. Risk factors for the transmission of diarrhoea in children: A case control study in rural Malaysia. ***International journal of epidemiology***, 1992, 21(4):812–8.

29. Feachem R, Koblinsky M. Interventions for control of diarrhoeal diseases in young children: promotion of breastfeeding. ***Bulletin of the World Health Organization***, 1984, 62:271–91.

30. Ahmed MU, Rashid M, Beguin S. Diarrhoea and feeding practices of young children attending two selected urban clinics in Dhaka. ***Journal of diarrhoeal diseases research***, 1992, 10(4):217–20.

31. Naficy AB et al. Epidemiology of rotavirus diarrhea in Egyptian children and implications for disease control. ***American journal of epidemiology***, 1999, 150(7):770–7.

32. Kangchuan C et al. The epidemiology of diarrhoeal diseases in South Eastern China. ***Journal of diarrhoeal diseases research***, 1991, 9(2):94–9.

33. Manderson L. Socioeconomic and cultural correlates of gastroenteritis among infants and small children in Malaysia. ***Journal of tropical paediatrics***, 1981, 27:166–76.

34. Jinadu MK. Childhood diarrhoea in rural Nigeria. Studies on prevalence, mortality and socio-environmental factors. ***Journal of diarrhoeal diseases research***, 1991, 9(4):323–7.

35. Wright CE et al. The role of home environment in infant diarrhea in rural Egypt. ***American journal of epidemiology***, 1991, 134(8):887–94.

36. King CK et al. Managing acute gastroenteritis among children: oral rehydration, maintenance and nutritional therapy. ***Morbidity and mortality weekly report: recommendations and reports***, 2003, 52(RR16):1–16.

37. Jousilahti P et al. Diarrhoeal disease morbidity and home treatment practices in Egypt. ***Public health***, 1997, 111(1):5–10.

38. Pang XL et al. Human calciviruses in acute gastroenteritis of young children in the community. ***Journal of infectious diseases***, 2000, 181:S288–94.