Nutritional outcome of appropriate feeding during and after acute diarrhoea in children

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أثر التغذية المناسبة أثناء الإسهال الحاد وبعده على الحالة الغذائية للأطفال

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تم اختيار مئة وعشرين طفلاً وتقسيمهم إلى مجموعتي دراسة في كل منهما ستون طفلاً . وكانت المجموعتان متماثلتين من حيث معطيات ما قبل التدخل ، ومن حيث نتائج ما بعد المعالجة أثناء مرحلة الإسهال الحاد . وبعد الخروج من المستشفى زودت المجموعة الأولى من الأطفال في كل أسبوع بالقدر الكافي من اللبن والطعام مع توعية أمهاتهم بالطرق الصحية للتغذية . أما أفراد المجموعة الثانية فقد كانوا يحصلون على الطعام والتوعية إذا ما طلبت الأمهات ذلك . وتمت متابعة تسعة وأربعين طفلاً من كل مجموعة مرة في كل أسبوع ولمدة أربعة أسابيع . ولقد تبين أن المجموعة الثانية كانت أكثر إصابة بالإسهال من المجموعة الأولى كما أن نوبات الإسهال المتكررة كانت تستغرق وقتاً أطول . زد على ذلك أن المجموعة الأولى حققت زيادة هامة في أوزان الأطفال بعد أربعة أسابيع من المتابعة .

A sample of 120 children with acute diarrhoea was divided into two equal study groups. There was no difference between groups in pre-intervention and post-intervention findings during the acute phase of diarrhoea. Upon discharge, Group A patients were supplied weekly with sufficient milk formula and cereal together with adequate nutritional advice while Group B patients were supplied with food or nutritional advice only if requested by the mothers. Forty nine patients from each group were followed each week for four weeks. Group B infants showed a higher incidence of recurrent diarrhoeal attacks and a significantly longer duration of recurrent diarrhoea than Group A infants. Moreover, Group A infants scored a significantly higher weight increment than Group B ones after four weeks of follow up.

Conséquences nutritionnelles d'une alimentation appropriée pendant et après la diarrhée aiguë chez les enfants

Un échantillon de 120 enfants souffrant de diarrhée aiguë a été divisé en deux groupes d'étude de taille égale. Il n'y a eu aucun changement dans les groupes entre le recueil des données avant l'intervention et les conclusions tirées après l'intervention lors de la phase aiguë de diarrhée. A la sortie de l'hôpital, on a fourni une quantité suffisante de lait en poudre et de céréales ainsi que des conseils nutritionnels appropriés aux sujets du groupe A tandis qu'on n'a donné de la nourriture et des conseils aux sujets du groupe B que sur demande de la mère. Quarante-neuf sujets de chaque groupe ont été suivis chaque semaine pendant quatre semaines. On a constaté une plus forte incidence des épisodes de diarrhée récidivante et une durée considérablement plus longue de la diarrhée récidivante chez les enfants du groupe B que chez ceux du groupe A. En outre, les enfants du groupe A ont connu des gains de poids considérablement plus importants que ceux du groupe B après quatre semaines de suivi.

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Introduction

As the nutritional complications of diarrhoea became more widely appreciated [*1–4*], greater attention has been focused on the appropriate dietary management of this illness [*5*]. The time-honoured practices of "resting the bowel", reduction of feeding or withdrawal of some food elements during diarrhoea are now called into question [*6,7*]. It is now universally agreed that there is a need to provide children with adequate nutritional support during and after diarrhoea, in order to minimize the adverse effects of the illness on the nutritional status, as well as to promote normal intestinal mucosal renewal and absorptive capacities [*6,8*]. The recommendations of the World Health Organization for continued feeding during diarrhoea [*9,10*] are now widely adopted, and their scientific justifications were based on many studies in different parts of the world involving different feeding modalities [*11–25*]. The scope of most of these excellent publications, however, has focused on the management during the acute phase of diarrhoea, hence the paucity of data in the literature concerning feeding during convalescence and the nutritional effects of adequate dietary intervention after acute diarrhoea. The present study was designed to elucidate this point, as well as study the impact of such practices on the risk of recurrent diarrhoea, the outcome and dietary management of these recurrent episodes by mothers at home.

Study samples

The sample size was 60 patients per treatment group according to standard statistical methods [*26*]. The inclusion criteria were: 1) males; 2) age from 4 to 12 months; 3) fed either on animal milk, milk formula and/or semisolid foods; 4) acute liquid diarrhoea of no more than three days in duration: diarrhoea being defined as the passage of at least three liquid stools per 24 hours; 5) moderate to severe dehydration [*10,27*]; 6) weight-for-age not less than 80% of the median of NCHS standards [*28*]; 7) no intake of any medication during the 48 hours preceding enrolment; and 8) informed consent of parents. The exclusion criteria were: 1) exclusively breast-fed babies; 2) obvious dysentery; 3) signs of overt malnutrition; 4) presence of a major systemic illness like pneumonia or tuberculosis; and 5) history of milk allergy or intolerance.

Treatment failures

Patients were considered to have deviated from the protocol, but were still included in the analysis 1) if during the acute stage, there had been aggravation of diarrhoea and dehydration necessitating resuscitation measures or if profuse/persistent vomiting or lactose intolerance developed; or 2) if during the convalescent and follow-up stages, there was recurrence of severe diarrhoea with bloating and distention on a milk-based diet. These patients were managed on a nonlactose, milk-free diet until recovery; followed by gradual reintroduction of milk over a period of one week. Diarrhoea starting one week thereafter was considered as a new episode.

Study design and methodology

Patients were selected from a large number of cases of acute diarrhoea brought to the Oral Rehydration Centre of the Alexandria University Children's Hospital, Alexandria, Egypt, during the peak morning hours. A maximum number of two or three patients were admitted at a time and were kept in hospital until termination of the diarrhoea

episode (return of stools to normal consistency as judged by the mother, or the passage of two consecutive formed stools as noticed by the investigator, or no passage of stools for 24 hours, provided there was no ileus).

Random assignment of patients to either Group A or B was done on the second day of hospital stay using permutation blocks of a fixed length of six. Patients from each group were kept in a separate ward in order to prevent them from exchanging their skills in the preparation of feeds.

Fluid therapy

Being initially dehydrated, all patients received rehydration therapy in the form of standard WHO oral rehydration solution (ORS), 100 ml/kg of body weight for moderately dehydrated cases, to be administered over a period of 4 to 6 hours by cup and spoon. For severely dehydrated cases, rehydration started by intravenous infusion of Ringer's lactate (70 ml/kg) over a period of 3 hours followed by ORS: 40 ml/kg given orally by cup and spoon over a period of 2 to 3 hours. Maintenance fluid therapy followed the initial rehydration and continued as long as there was diarrhoea. It was given in the form of standard ORS in amounts of 10 ml/kg of body weight/diarrhoeal stool. Plain water was offered as well, in amounts not exceeding 50% of the prescribed amounts of ORS, taking an accurate record of ingested amounts.

Feeding protocol

Feeding during the acute phase

Feeding during the acute phase began 4 to 6 hours after the start of rehydration therapy or sooner if initial rehydration had been completed. For the purpose of standardization, all children were given a commercially available adapted (humanized) milk formula as well as a commercially available cereal mixture. The milk formula provides 1.8 grams of milk protein, 3.5 grams of fats, 7.0 grams of lactose, and 67 kcal per 100 ml of regularly reconstituted formula. The cereal powder provides 90.0 grams of carbohydrate (lactose-free), 4.0 grams of nonmilk proteins, 2.1 grams of fats and 398 kcalories per 100 grams of powdered product.

Starting after initial rehydration, all children were offered the adapted milk formula at half strength plus the cereal mixture (to be added to the milk) in amounts of 5 grams of cereal powder for each 100 ml of reconstituted milk formula. The amounts offered to the child were 150 ml/kg of body weight/24 hours. The child was allowed a feed every 3 hours, and an accurate record (to the nearest gram) of the actually ingested amounts was kept. After 24 hours, the milk formula was given at full strength, and the amount of cereal was increased to 10 g/100 ml reconstituted milk formula. This continued until full recovery and termination of the diarrhoea episode, and for a minimal period of 4 days (calculated from the start of rehydration).

Feeding during convalescence and follow-up period

On discharge from hospital, the 120 children included in the study were allocated to either regimen A or B according to the randomization done on the second day of study.

Group A (60 children): Mothers of these children were trained starting from the second day of hospital stay in the preparation and administration of the study diet after discharge; they were also trained in the preparation of other semi-solid weaning diets appropriate for the age of their children. This training included actual food demonstrations, as well as active participation of the mothers in the preparation of recipes

based on locally available and affordable food items. On discharge, they were supplied weekly with sufficient amounts of milk powder and cereal and instructed to prepare them in the proper way and present them to the baby three times daily. They were instructed also to present another two or three extra weaning feeds composed of either mashed vegetables (potato + carrot); yoghurt + honey; egg or cheese; or mashed fruit (e.g. banana). The child's acceptance and like or dislike of the meal were taken into consideration in the choice of a certain type of food.

Group B (60 children): This group was not supplied with milk or cereal and managed like other cases of diarrhoea discharged routinely from the hospital after recovery. Sufficient instructions were given only on discharge on the correct methods of preparing and administering feeds to the babies.

Laboratory studies

Laboratory studies comprised: 1) routine stool analysis for parasites; 2) stool culture for known bacterial pathogens [*29,32*]; 3) ELISA screening of stools for rotavirus [*33*]; 4) total serum solids on admission and after rehydration [*34*]; 5) serum sodium and potassium on admission and after 24 hours [*35*]; 6) screening of stools for carbohydrate malabsorption by stool pH and faecal-reducing substances on admission, after 6 hours and every 12 hours until recovery [*36,38*].

Assessment and collection of data

Period of hospital stay

For all admitted cases, a full clinical examination was conducted on admission intervals, then after 2, 4, 6 and 12 hours and then every 12 hours till complete recovery. A special form was used to record the following: 1) history, stressing the nutritional history and the feeding given over the previous 24 hours, the frequency, consistency and duration of diarrhoea, the duration and severity of vomiting, the history of fever, urine flow and intake of drugs; 2) anthropometric measurements: nude weight (using a Secca Correcta baby-weighing scale having an accuracy of 10 grams) was obtained at 0, 6 and 24 hours and on recovery. Length was measured on admission; 3) degree of dehydration and rehydration requirements [*10,27*]; 4) diarrhoea: number and consistency of motions, accurate stool weight and duration of the diarrhoea episode, measured from admission to the last abnormal stool; 5) frequency and duration of vomiting; 6) time needed for full initial rehydration, measured from the start of rehydration to disappearance of signs of dehydration and/or a dehydration score of less than 2 [*27*]; 7) feeding: amount and dilution of milk formula and amounts of cereals consumed.

Period of follow-up after discharge

Patients were followed up at weekly intervals for a duration of four weeks after their discharge from hospital. This follow-up was achieved through either repeated visits to the hospital or home visits by the investigator accompanied by a nurse. This was done also for patients who did not return for follow-up visits on scheduled days. The following procedures were applied on each visit:

For Group A: Feeding advice was reiterated, and additional information was given, if necessary. Mothers were asked to repeat the information delivered to them at the previous visit. Sufficient food (milk and cereal) and a multivitamin preparation were supplied to each patient. Diet intake was as-

sessed at each visit by a 24 hour recall using a special list to record the number of feeds given during the preceding 24 hours; how milk feeds were prepared (amount. concentration, etc.); how cereal feeds were prepared (amounts given and method of preparation): other foods presented to the child, the number of feeds, their composition, their acceptance by the child, and how much was given.

The compliance of parents with the feeding advice given to them was recorded as either: good or bad. History was recorded as regards the appetite, the recurrence of diarrhoea during the previous week and how it was managed; the recurrence of vomiting during the previous week and how it was managed; the number and consistency of stools in the preceding 24 hours; as well as any other illness or complaint during that week. Thereafter, the child was weighed nude and physically examined for signs of malnutrition or specific vitamin deficiencies.

For Group B: History, physical examination and weight was assessed. A vitamin preparation was supplied to each patient as a stimulus to encourage parents to continue participation in the follow-up study. No food was supplied to these children, and the feeding advice was not reinforced nor repeated unless sought specifically by the parents. In other words, these children followed the usual routine schedule for cases of diarrhoea after their discharge from hospital and reverted to their usual home diet. Assessment of dietary intake was done in the form of a closed questionnaire in order not to elicit the request of the mother for detailed information.

Analysis of data

Computer analysis of data was done using the *SPSS-PC V3* program for descriptive and analytical statistics. Student's *t* test, nonparametric tests and chi-square test were used, and a level of significance of 5% was adopted.

Results and discussion

It is clear from Table 1 that the two groups of infants assigned for this study are well matched as regards all the pre-intervention features. There were no significant statistical differences between the two groups in terms of age or feeding patterns just before and after the start of diarrhoea, duration of diarrhoea and vomiting before presenting to hospital, frequency of diarrhoea and vomiting on the day prior to admission and the presence of anorexia, vomiting and/or fever. The nutritional status, degree of dehydration, time needed for full initial rehydration, weight gain after full initial rehydration, serum sodium and potassium and serum total solids before and after rehydration were also comparable in the two studied groups of patients (Table 2). As regards the etiology, the results also matched. The most commonly isolated pathogens in Groups A and B respectively were rotavirus (25.0% and 23.3%), enteropathogenic *Escherichia coli* (21.7% and 20%), enterotoxigenic *E. coli* (3.3% and 3.3%), salmonella group B (3.3% and 5%), *Campylobacter jejuni* (3.3% and 3.3%) and negative isolation (43.3% and 45%) (Table 1).

Table 2 illustrates the data collected from patients during their hospital stay, i.e. during the acute and early convalescent stages. Generally, it can be stated that both groups of patients gave comparable results as regards the duration and frequency of diarrhoea, the purging rate, the frequency and duration of vomiting, the fluid intake including oral rehydration solution and other plain fluids, the milk formula intake and the mean daily caloric consumption. The weight on

Table 1 **Pre-intervention findings**

Presenting feature	Group A ($n = 60$) Mean	SD	Group B ($n = 60$) Mean	SD	p^*
Age (months)	7.7	2.1	7.5	2.1	0.962
Weight after rehydration as % of standard for age	103.4	12.6	101.3	11.3	0.322
Height as % of standard for age	99.5	5.2	99.9	4.6	0.584
Diarrhoea:					
Duration (days)	2.2	0.9	2.4	0.9	0.222
Frequency in last 24 hours	12.5	4.9	11.3	4.5	0.177
Vomiting:					
Duration (days)	1.8	0.9	1.8	0.9	0.727
Frequency in last 24 hours	3.8	3.9	3.5	3.1	0.566
Dehydration (Fortin and Parent score)	7.8	1.0	7.4	1.0	0.077
Time since last urine (hours)	5.8	1.3	5.6	1.3	0.447
	No.	**%**	**No.**	**%**	p^{**}
Degree of dehydration:					
Mild	0	0.0	0	0.0	
Moderate	51	85.0	55	91.7	0.324
Severe	9	15.0	5	8.3	
Other symptoms:					
Anorexia	39	65.0	38	63.3	1.000
Vomiting	41	68.3	46	76.7	0.414
Fever	38	63.3	41	68.3	0.700
Feeding pattern before illness:					
Milk formula (commercial)	7	11.7	11	18.3	
Cow's milk	4	6.7	5	8.3	0.530
Milk or formula + other foods	49	81.7	44	73.3	
Adequacy of feeding:					
Adequate	55	91.7	56	93.3	
Not adequate	5	8.3	4	6.7	1.000
Feeding in last 24 hours:					
Starved or plain fluids only	18	30.0	12	20.0	
Half strength milk or formula	3	5.0	5	8.3	
Full strength milk or formula	12	20.0	16	26.7	0.518
Milk + other foods	27	45.0	27	45.0	
No milk, other foods only	0	0.0	0	0.0	
Adequacy of feeding in last 24 hours:					
Adequate	21	35.0	23	38.3	
Not adequate	39	65.0	37	61.7	0.850

p*: p *values of unpaired* t *test: all are nonsignificant* ($p > 0.05$)
p**: p *values of* χ^2 *test: all are nonsignificant* ($p > 0.05$)

Table 1 **continued**

Presenting feature	Group A ($n = 60$) No.	%	Group B ($n = 60$) No.	%	p^{**}
Presence of rotavirus:					
No	45	75.0	46	76.7	
Yes	15	25.0	14	23.3	1.000
Etiology:					
Enteropathogenic *E. coli*	13	21.7	12	20.0	
Enterotoxigenic *E. coli*	2	3.3	2	3.3	
Salmonella group B	2	3.3	3	5.0	0.998
Campylobacter jejuni	2	3.3	2	3.3	
Rotavirus	15	25.0	14	23.3	
Negative isolate	26	43.3	27	45.0	

p*: p *values of unpaired* t *test: all are nonsignificant* ($p > 0.05$)
p**: p *values of* χ^2 *test: all are nonsignificant* ($p > 0.05$)

recovery was also matching in the two groups. In that respect it is important to stress here that the weight after full initial rehydration was considered in this study as the baseline weight to overcome the bias in results caused by the increments in weight resulting from rehydration, which makes it impossible to differentiate between the effects of rehydration and feeding on the weight.

Table 2 also portrays the state of sugar tolerance in the two groups of infants. It can be seen that 61.7% and 68.3% of patients of Groups A and B respectively were tolerant to sugars. These patients did not show any clinical or laboratory evidence of carbohy-

Table 2 **Findings during period of hospitalization**

Finding	Group A ($n = 60$) Mean	SD	Group B ($n = 60$) Mean	SD	p^{*}
Diarrhoea:					
Duration hours	97.2	56.7	94.2	59.4	0.778
Total no. of diarrhoea stools	26.0	24.5	20.7	16.9	0.164
Average no./day	5.7	2.5	5.0	1.7	0.078
Total amount of stools (g/kg body weight)	296.3	265.7	279.9	211.2	0.709
Average amount/day	68.0	31.3	70.0	35.3	0.748
Vomiting:					
Total number	3.6	4.9	3.6	6.0	0.960
Average no./day	0.8	0.9	0.8	1.1	0.910
Duration (hours)	1.5	1.8	1.4	2.1	0.815
Time for initial rehydration (hours)	5.0	0.8	4.9	0.7	0.324

p*: p *values of unpaired* t *test: all are nonsignificant* ($p > 0.05$)

Table 2 continued

Finding	Group A (n = 60) Mean	SD	Group B (n = 60) Mean	SD	p^*
Time of first voiding of urine (hours)	4.5	0.7	4.3	0.7	0.107
Intake:					
ORS (ml/kg/day)	99.2	26.4	98.3	33.6	0.873
ORS + plain fluids and water (ml/kg/day)	110.6	30.9	104.2	34.8	0.289
Milk formula (ml/kg/day)	67.9	20.4	73.0	24.4	0.215
Total calories/kg/day	36.4	10.9	39.9	12.7	0.110
Changes in body weight as % of rehydrated weight:					
After initial rehydration	+7.8	1.5	+7.4	1.7	0.138
On recovery	−1.95	1.8	−1.48	2.1	0.167
Laboratory findings:					
Total serum solids (g/dl)					
0 hour	8.5	0.6	8.4	0.6	0.406
6 hour	7.2	0.4	7.2	0.5	0.801
Serum potassium (mEq/l)					
0 hour	4.3	0.3	4.2	0.3	0.181
24 hour	4.6	0.3	4.6	0.4	0.938
Serum sodium (mEq/l)					
0 hour	138.1	3.9	138.2	3.3	0.920
24 hour	143.2	3.1	143.2	3.1	0.906
Duration of reducing substances in stools (days)	0.7	1.3	0.6	1.6	0.555

	No.	%	No.	%	p^{**}
Tolerance to sugars:[1]					
Tolerant	37	61.7	41	68.3	
Malabsorption	19	31.7	18	30.0	0.362
Intolerant	4	6.7	1	1.7	
Onset of malabsorption or intolerance:					
Early	21	35.0	16	26.7	
Late	2	3.3	3	5.0	0.583
Not applicable	37	61.7	41	68.3	
Type of sugar:					
Glucose	2	3.3	5	8.3	
Lactose	5	8.3	5	8.3	0.327
Glucose + lactose	16	26.7	9	15.0	
Not applicable	37	61.7	41	68.3	

[1] *Tolerant = absence of clinical and laboratory evidence of carbohydrate malabsorption. Malabsorption = presence of laboratory evidence only. Intolerance = presence of both clinical and laboratory evidence*

p^*: *p values of unpaired* t *test: all are nonsignificant* ($p > 0.05$)

p^{**}: *p values of* χ^2 *test: all are nonsignificant* ($p > 0.05$)

drate intolerance or malabsorption. Nineteen Group A patients (31.7%) and 18 Group B patients (30%) were found to have sugar malabsorption. These infants showed only laboratory evidence of carbohydrate malabsorption in the form of a low stool pH (< 6) (using Combistix, Ames Company) and/or faecal reducing substances > 0.5g% (using Clinitest tablets, Ames Company). These patients were successfully managed on regular milk formula and were not shifted to lactose-free milk formula. A small minority of cases (four cases in Group A and one in Group B) were considered sugar intolerant and treatment failures. These patients showed both clinical manifestations of carbohydrate intolerance (in the form of enormous explosive watery stools, abdominal distention, borborygmi, colics and/or excoriation of buttocks) as well as laboratory evidence of carbohydrate malabsorption. Marked clinical improvement of these cases occurred upon elimination of lactose from their feeds and shifting them to a lactose-free formula. The duration of positive stools for carbohydrate malabsorption in these cases ranged from 2 to 9 days with a mean of 4 ± 2.5 days. These patients gradually reverted to regular milk formula before being discharged from hospital without any major inconvenience.

During the four weeks follow-up period, some patients were excluded from the study either because of developing a serious illness other than diarrhoea (one patient in Group A and two patients in Group B developed bronchopneumonia, otitis media and bronchiolitis, respectively) or for parental reasons (change of address or unwillingness to continue the study). Nevertheless, 49 infants (representing 81.7% of cases) of each group completed the weekly follow-up visits up to a month after recovery and discharge from hospital. In all these cases the study did not report any complications that could be attributed to diarrhoea or feeding, like carbohydrate intolerance, chronic diarrhoea, food allergy or malnutrition. Even in patients with a history of recurrent attacks of acute diarrhoea, the attacks were mild ones unaccompanied by significant dehydration, and they ended with uneventful recovery without any need for hospital readmission.

Table 3 Number of days of diarrhoea during four weeks of follow-up

Number of days of diarrhoea	Group A		Group B		χ^2
	No.	%	No.	%	
0	31	63.3	24	49.0	20.608
1– 3	6	12.2	1	2.0	($p < 0.05$)
4– 6	9	18.4	5	10.2	significant
7– 9	3	6.1	14	28.6	
10–12	0	0.0	5	10.2	
Total number of patients	49	100.0	49	100.0	
Range of number days of diarrhoea	2–9		2–12		
Mean ± SD	1.4 ± 2.4		3.3 ± 4.2		

p = 0.004 (significant)

Group B infants had a significantly longer duration of recurrent diarrhoea than Group A (Tables 3 and 4). As regards the feeding management, a significantly higher percentage of patients in Group B were managed inappropriately, whether during the recurrent diarrhoeal attacks or during the illness-free and convalescent period

Table 4 Number of attacks of diarrhoea during four weeks of follow-up

Number of days of diarrhoea	Group A		Group B		χ^2
	No.	%	No.	%	
0	31	63.3	24	49.0	2.157
1	17	34.7	18	36.7	($p > 0.05$)
2	1	2.0	7	14.3	
Total number of patients	49	100.0	49	10.0	
Range of number days of attack	1–2		1–2		
Mean ± SD	1.1 ± 0.3		1.3 ± 0.5		

p = *0.043 (significant)*

Table 5 Food consumption during follow-up

Food consumption compared to amounts consumed before illness	Group A		Group B		χ^2
	No.	%	No.	%	
Same average as before	3	6.1	3	6.1	21.15
Above average	43	87.8	27	55.1	($p < 0.001$)
Below average	3	6.1	19	38.8	significant
Total	49	100.0	49	100.0	

Table 6 Appropriateness of feeding during illness-free periods and recurrent diarrhoea during follow-up

Appropriateness of feeding	Group A		Group B		χ^2
	No.	%	No.	%	
Illness-free periods					
Appropriate	46	93.9	30	61.2	13.42*
Inappropriate	3	6.1	19	38.8	($p < 0.05$)
During recurrent diarrhoea					
Appropriate	16	88.9	8	32.0	15.15*
Inappropriate	2	11.1	17	68.0	($p < 0.05$)
Not applicable	31	–	24	–	

* = *significant*

Table 7 **Body weight increments (expressed as percent of standard expected increment for age) at the end of four weeks of follow-up**

Body weight changes (% of standard expected)	Group A ($n = 45$)	Group B ($n = 45$)
Range	−149.6 to +491.5	−170.9 to +341.9
Mean ± SD	233.9 ± 123.8	91.2 ± 115.8

$p < 0.001$ *(significant)*

(Tables 5 and 6). Moreover, Group B infants scored a significantly lower increment in weight after four weeks than did Group A infants (Table 7 and Fig. 1). In other words, when the weight increment achieved by each patient was expressed as a percentage of the expected standard weight gain achieved by normal Egyptian infants of the same age [*39*], it was found that Group A children showed more than double the increment achieved by Group B infants and more than double the expected normal weight gain for Egyptian infants of the same age. This shows that Group A achieved very good catch-up growth. Such catch-up growth was not observed in Group B infants, who continued to gain weight only at the expected rate (Fig. 2 and Table 8).

The above findings emphasize that an adequate nutritional education for mothers of children suffering from diarrhoea should emphasize the need for increasing the caloric intake through appropriate recipes based on locally available and affordable foodstuffs.

In conclusion, the results of this study reconfirm the important message that the successful management of diarrhoea rests on two pillars: rehydration and adequate feeding during and after diarrhoea. Successful nutritional management requires education and good feeding practices during diarrhoea, as well as a supply of "extra energy" after diarrhoea to compensate the nu-

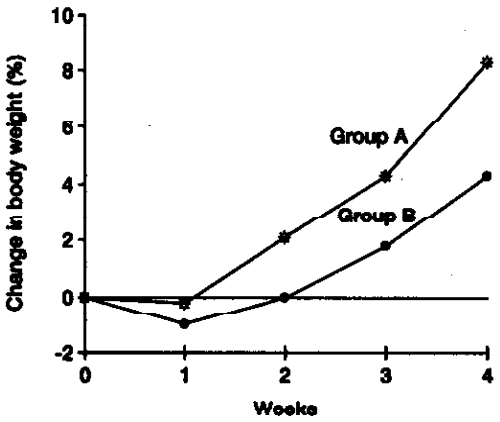

Figure 1 **Mean weekly body changes (as % of rehydrated weight)**

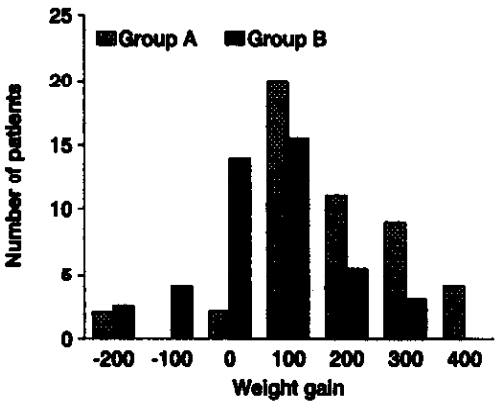

Figure 2 **Mean body-weight increments (as % of standard expected increments) at the end of four weeks of follow-up**

Table 8 **Weekly body weight changes during four weeks of follow-up (expressed as % of rehydrated weight)**

	After one week				After two weeks				After three weeks				After four weeks			
	Group A		Group B		Group A		Group B		Group A		Group B		Group A		Group B	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Weight gain %																
–13 to	2	4.1	8	16.3	1	2.0	6	12.2	1	2.0	5	10.2	0	0.0	2	4.1
–6 to	28	57.1	25	51.0	14	28.6	25	51.0	10	20.4	15	30.6	2	4.1	9	18.4
+1 to	19	38.8	16	32.7	33	67.3	15	30.6	29	59.2	23	46.9	18	36.7	24	49.0
+8 to	0	0.0	0	0.0	1	2.0	3	6.1	9	18.4	6	12.2	26	53.1	14	28.6
+15 –	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	6.1	0	0.0
Total number of cases	*49*	*100.0*	*49*	*100.0*	*49*	*100.0*	*49*	*100.0*	*49*	*100.0*	*49*	*100.0*	*49*	*100.0*	*49*	*100.0*
Mean ± SD	–0.43 ± 3.23		–1.19 ± 4.62		2.25 ± 3.81		0.09 ± 5.42		4.47 ± 4.19		1.55 ± 5.99		8.55 ± 4.45		4.59 ± 5.22	
Range	–10.3 to 4.8		–12.6 to 5.9		–10.3 to 9.9		–12.6 to 9.8		–6.6 to 12.8		–11.1 to 12.5		–3.6 to 18.6		–6.2 to 14.4	
t	0.96				2.29				2.81				4.07			
p	0.34				0.02				0.006				0.0001			
	nonsignificant				significant				significant				significant			

tritional "losses" caused by the rapid transit time and/or the cultural practice of withholding or reducing food during diarrhoea. This practice of supplying extra energy will have its impact on the prevention and correction of malnutrition, and will help in breaking the vicious cycle of diarrhoea and malnutrition.

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