Management of Malnourished Children with Acute Diarrhoea and Sugar Intolerance

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Summary

A protocol of nutritional rehabilitation using fermented milk, vegetable oil and caster sugar has been tested on 54 Senegalese children, aged 6–36 months, admitted with acute diarrhoea and malnutrition.

At the time of admission, 39 per cent of children were dehydrated and 26 per cent had sugar intolerance. In the course of treatment three went home against medical advice and one died from acute pneumonia with respiratory-heart failure. Among the cases of marasmus there were no differences in mean weight gain between children with sugar intolerance and others despite a longer duration of diarrhoea in the first group. Furthermore, the experimental protocol has never been compromised because of worsening diarrhoea or weight loss.

These results indicate that a formula based on fermented milk together with oral rehydration can be used to treat malnourished children with acute diarrhoea and sugar intolerance

Introduction

Acute diarrhoea and malnutrition are often associated. It is commonly recognized that early nutritional rehabilitation is necessary in cases of acute diarrhoea.[1] However, using whole milk is still a matter of debate because of frequent sugar intolerance noted among such children.[2,3] Recent studies suggest that using fermented milk could be an important alternative for nutritional rehabilitation of malnourished children with acute diarrhoea showing evidence of sugar intolerance.[4,5]

The aim of this study was to evaluate the efficacy of a protocol using oral rehydration and a highly nutritive mixture of fermented milk, oil, and sugar. This study has been conducted among pre-school children admitted with acute diarrhoea and malnutrition, some of them with sugar intolerance, others with no evidence of sugar intolerance.

Study Methods

The study has been conducted in a centre for nutritional rehabilitation, Hôpital du Roi Baudouin, Pikine-Guedjawaye, a suburban area of about 600 000 people near Dakar, the capital city of Senegal. This centre, created in 1984, works as a day-hospital. Children stay with their mother from 8 am to 6 pm and come back every day until recovery.[6]

Correction and prevention of dehydration is achieved using oral rehydration with the WHO/UNICEF salts and according to WHO guidelines.[1]

Nutritional rehabilitation starts from the first day and is based on a mixture of fermented milk, vegetable oil, and caster sugar that provides about 100 calories per 100 ml.[7] The mixture is prepared according to the following procedure: 3 volumes of dried skimmed milk are mixed with 1 volume of caster sugar and 1 volume of vegetable oil. This makes a paste that can be kept up to 15 days in a cool dry place. Every night the nurses mix 1 volume of the paste with 4 volumes of water and 1 glass of yogurt. The following morning the mixture is ready for use for nutritional rehabilitation of malnourished children.

Children receive, on average, 100 ml/kg per day when starting the treatment in six to eight small meals. When appetite returns quantities of the mixture are increased according to the child's hunger. The regimen is then completed with enriched porridge. When children are not yet weaned, breast feeding is encouraged, never interrupted, and the mixture is given in addition.

For this survey, the protocol of rehabilitation has been the same for marasmus (weight for height below 80 per cent of NCHS standard) and for kwashiorkor (presence of oedema). The fermented milk-oil-sugar mixture has been given the same way even when a child had clinical sugar intolerance at the beginning of treatment, as defined by watery stools with acid pH (< 5.5) and presence of reducing sugars.[8] Screening of sugar in stools has been done with clinitest.[9]

Data have been analysed on microcomputers using standard statistical packages.

Results

The study lasted 9 months, from November 1985 to July 1986. During the period 54 children with acute

TABLE 1
Characteristics of the 54 children admitted in the survey

Variables		All %	(n)	Sugar+ %	(n)	Sugar− %	(n)	P (t-test)
Sex	M	42.6	(23)	17.4	(4)	82.6	(19)	NS
	F	57.4	(31)	32.3	(10)	67.7	(21)	
Age	6–12 months	35.2	(19)	47.4	(9)	52.6	(10)	
	13–24 months	55.6	(30)	16.7	(5)	83.3	(25)	$P<0.05$
	25–36 months	9.3	(5)	0.0	(0)	100.0	(5)	
Weaning	Breast-fed	44.4	(24)	41.7	(10)	58.3	(14)	$P<0.02$
	Weaned	55.6	(30)	13.3	(4)	86.7	(26)	
Type	Marasmus	88.9	(48)	25.0	(12)	75.0	(36)	NS
	Kwashiorkor	11.1	(6)	33.3	(2)	66.7	(4)	
Dehydration	Yes	38.9	(21)	38.1	(8)	61.9	(13)	NS
	No	61.1	(33)	18.2	(6)	81.8	(27)	
Vomiting	Yes	42.6	(23)	47.8	(11)	52.2	(12)	$P<0.01$
	No	57.4	(31)	9.7	(3)	90.3	(28)	

NS: not significant.

diarrhoea and malnutrition were admitted at the Pikine-Guedjawaye centre. Among them, 50 children (93 per cent) have been followed-up until recovery, three (6 per cent) absconded during treatment, and one child died (2 per cent) at day 5 from acute pneumonia with respiratory and cardiac failure. For those three children who absconded the growth curve was going upward at the time of departure.

At admission 14 children (26 per cent) had clinical sugar intolerance: 11 had marasmus, two had kwashiorkor, and one absconded later. For this last case the diarrhoea had stopped when he left at day 4.

Table 1 shows the characteristics of the 54 children admitted.

There was a larger number of female children; among girls, there are more cases of sugar intolerance than among boys, but the difference is not significant.

With regard to age, all children with sugar intolerance are in the 6–24 months age group. Sugar intolerance was even more frequent in the 6–12 age group (47 per cent) than in the 13–24 age group.

Distribution was equal with regard to weaning, but percentage of sugar intolerance is higher in the breast-fed group ($P<0.02$).

The main form of malnutrition was marasmus and the percentage of sugar intolerance was higher among the kwashiorkor cases (difference not significant).

Thirty-nine per cent of children had signs of dehydration at the time of admission. Among dehydrated children the percentage of sugar intolerance is higher, but not significantly so.

Forty-three per cent of children were vomiting at time of admission. The percentage of sugar intolerance was higher in this group than in non-vomiting children ($P<0.01$).

Table 2 shows the progress of 44 marasmus cases until recovery. Marasmus cases with sugar intolerance were, on average, younger than those who did not show any sugar in stools at admission (12.6 against 18.3 months).

Sugar intolerance was associated with better nutritional status since with the same mean weight at admission, the mean age of intolerant children is lower.

The weight gain during treatment with the milk-oil-sugar mixture had been the same in the two groups—within 24 hours, within 1 week, and at time of hospital discharge. The duration of treatment was the same in the two groups and the weight gains at time of discharge expressed in g/kg body weight or weight/day were equivalent (15.1 and 13.7 for the sugar intolerant).

Correcting dehydration with WHO solution was somewhat longer in case of sugar intolerance; however, the difference is not significant. Furthermore, despite the same duration of diarrhoea prior to admission (5.6 and 6.0 days for the intolerants) it appears that duration of diarrhoea during the treatment is longer among the intolerants (4.6 days), about twice the time than than for the others (2.3 days).

In the kwashiorkor group, no comparative study could be done since the group is too small. For these six children, the progress was favourable and the weight gain at time of discharge was 8.5 g/kg per day. Weight increase was smaller than for the marasmus, in part due to loss of weight when losing oedemas.

Discussion

Lactose intolerance in case of acute diarrhoea associated with malnutrition has already been docu-

TABLE 2
Evolution of 44 marasmus cases until recovery

Variables	Marasmus sugar+ ($n=11$)	Marasmus sugar− ($n=33$)	P (t-test)
Age (months)	12.63±4.43	18.30±6.96	$P<0.01$
Weight at admission (kg)	6.759±0.788	6.748±1.051	NS
Weight at 24 hours	6.898±0.753	6.903±1.046	NS
Weight at 1 week	7.309±0.695	7.321±1.125	NS
Weight at discharge	7.904±1.034	8.015±1.002	NS
Duration of treatment (days)	14.45±8.07	13.72±6.52	NS
Weight gain (g/kg/d)	13.78±6.03	15.13±4.38	NS
Duration of dehydration (days)	2.0±1.22	1.2±0.42	NS
Duration of diarrhoea (days)	4.63±2.73	2.39±1.22	$P<0.01$

NS: not significant.

mented.[10] Taking our sample into consideration it is highly likely that lactose was the most likely sugar found in stools. In another study conducted in Senegal among malnourished children age 8–36 months, lactose malabsorption defined by measure of glycaemia was found to be as high as 60 per cent at age 1 year and milk was poorly tolerated among 20 per cent of children.[11] Our results are close to this last number since one out of four children had sugar intolerance at admission.

Rotavirus diarrhoea which frequently occurs among infants often causes lactose malabsorption.[2,12] In this case vomiting as well as dehydration are often observed.[13] In Senegal, rotavirus appears as the leading aetiological agent of diarrhoea among young children, in particular among girls; its prevalence ranges from 10 to 25 per cent depending on study areas.[14] In our study the likelihood of a viral infection among children who were found to be sugar intolerant could explain differences in age, sex, and clinical signs. This hypothesis could also explain the relatively better nutritional status of intolerant children if one admits that lactase deficiency associated with malnutrition plays a role in rotavirus pathogenecity.[15]

The difference in weaning status is probably an age effect. In Senegal weaning occurs, on average, between age 1 and 2 years.

With regard to the type of malnutrition, our results are consistent with other data: disaccharide deficiency is most frequent in case of protein malnutrition.[3]

With regard to treatment, our protocol was found to be very efficient for the two groups of children. In case of acute diarrhoea associated with malnutrition, the WHO formula was found to be efficient despite a long time required to treat initial dehydration (24–48 hours in our study). As already described elsewhere, there is a danger of retention of water and salt and rehydration has to be carried out slowly and primarily based upon child's thirst.[16]

A formula based on milk, casein, oil and sugar has already been used with success for nutritional rehabilitation of children severely malnourished with acute diarrhoea.[17] The nourishing mixture used in this survey is simple to prepare and has been well tolerated by children with sugar intolerance. In this group, the protocol has never been stopped because of weight loss or because of worsening diarrhoea. Furthermore, despite a longer duration of diarrhoea, weight gains have been comparable with children without sugar intolerance. These results are comparable with those of other authors indicating that the use of fermented milk facilitates lactose digestion among adults as well as children with lactase deficiency.[18]

In conclusion, very simple techniques allow one to efficiently treat children with acute diarrhoea and malnutrition, and the use of fermented milk seems to be a good alternative for treating children with sugar intolerance.

Simplicity of infrastructure (a room, a scale, a full time nurse) as well as the very low cost (about 0.5 ECU per day and per child) could permit the widespread use of this technique in the most remote and poorest places, where prevalence, rates of diarrhoea and malnutrition are high.

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