APPENDIX V-f

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Experience with a Mixture of Wheat-Noodles and Casein in the Initial Dietary Therapy of Infants and Young Children with Protein-Calorie Malnutrition or Acute Diarrhea

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ABSTRACT

The usefulness of a mixture of wheat noodles and a casein based formula in the early management of protein calorie malnutrition and acute diarrhea was studied. Eleven children with second or third degree malnutrition were managed with the casein based formula until 75 Kcal/Kg body weight/day (5 children) or 50 Kcal/Kg body weight/day (6 children) were being consumed. Additional increases up to 125 - 150 Kcal/Kg/day were made by the addition of wheat noodles (maximum Kcal ratio of formula to noodles, 50:50). Ten better nourished children with acute diarrhea were similarly treated, except that noodles were added once an intake of 25 Kcal/Kg/day had been achieved (Kcal ratio of formula to noodles thereafter was 50:50). Both groups did well. Response of the malnourished children, gauged by clinical course and balance studies, paralleled that previously documented using only formula diets. Children with acute diarrhea recovered well but had expectly higher fecal energy losses than previously seen in healthy children consuming the same diet. About one third of the excess fecal energy loss was accounted for by carbohydrate, two thirds by fat. Diets containing substantial amounts of noodles, a low cost widely available staple, can be appropriately used in the refeeding of chronic malnutrition and acute infectious enteritis.

Key Words

Diarrhea
Infantile Malnutrition
Wheat
Infant Nutrition
Management of Diarrhea
Management of Malnutrition

The initial clinical management of infants and young children with severe protein-calorie malnutrition requires careful attention to fluid and electrolyte balance (1), to the diagnosis and treatment of infections (2), and to the provision of macro and micro-nutrients to meet physiological requirements and to replace deficits (3). Realimentation has traditionally been accomplished with milk-derived formulas because of the high quality protein, relative energy density, and ease of administration. However, the high prevalence of diarrhea and secondary lactose malabsorption complicating malnutrition frequently necessitates the use of lactose-free (4) or lactose-limited formulas (5). Furthermore, the ever increasing cost of milk products requires the development of more economical approaches to refeeding. These considerations are equally important in the early nutritional management of well nourished patients recovering from acute diarrhea. For these reasons we have attempted to develop therapeutic dietary regimens using commonly available and relatively inexpensive staple foods in addition to or in place of milk-derived products. The results of our early experience with wheat noodles are reported herein.

METHODS[1]

Initial management of malnutrition

Eleven Peruvian mestizo male patients with moderately severe or severe protein-calorie malnutrition were entered in the study on the day of their admission to the inpatient treatment facilities of the Instituto de Investigación Nutricional. Their ages and selected indicators of their nutritional and clinical status are presented in Table 1. These clinical data are generally similar to those from a larger group of patients whose initial management with a casein, vegetable-oil, and glucose, maltose, or sucrose formula was described previously (3); thus, the previous group of patients can serve for the purpose of comparison. The initial management of our patients, as discussed in greater detail in that paper, involves the treatment of documented or suspected infections and the correction of fluid and electrolyte inbalances, either orally or by the intravenous route.

Dietary treatment is begun as soon as the patients' general condition and stool output permit. In children whose fecal excretion is less than 100 to 150 g per day (wet weight) formula feedings in addition to any necessary fluid and electrolyte therapy are usually introduced within the first 1-2 days. The feedings are initiated at a level of 25 Kcal/Kg/day and are increased by 25 Kcal/Kg/day every 2 to 3 days if the clinical condition and stool output are satisfactory

The dietary energy is divided among protein (8%), fat (48%), and carbohydrate (44%). In the present studies protein was provided by casein and/or wheat noodles, fat by a mixture (80:20) of soybean and cottonseed oils, and carbohydrate by sucrose and/or the staple (Table 2). Sodium, potassium, and vitamin and mineral mixtures were added to the diets as previously described (6). The diets were analyzed for nitrogen, energy, sodium, and potassium contents during each period to ascertain that they were prepared correctly.

In the present studies two dietary protocols were followed. The first five patients (Diet Group 1) received only the casein, sucrose, oil formula until they reached a level of intake of 75 Kcal/Kg/day. The next increment of 25 Kcal/Kg/day was made by the addition of pasta so that at an intake of 100 Kcal/Kg/day 25% of the energy was supplied by noodles.

With each subsequent increase in intake, all of the additional energy was provided by noodles. When it became apparent that these children recuperated favorably with this progression of formulas, a second set of diets replaced the first. In the second diet group, the staple was introduced when the diet was increased from 50 to 75 Kcal/Kg/day (50:25, formula : pasta). At intakes of 100 Kcal/Kg/day and with each increase thereafter, noodles provided half of the total energy consumed.

Once the children in both diet groups reached a level of intake of 50 Kcal/Kg/day continuous metabolic collections were maintained for at least 3 days at each level of intake, or for the entire diet period, if the level of intake was "advanced" more rapidly. Fecal wet and dry weight, nitrogen, fat, and energy were measured by standard techniques (7-9), and urine nitrogen was determined in order to calculate apparent nitrogen balances. The evolution of serum albumin was monitored at approximately weekly intervals.

<u>Dietary management of acute diarrhea</u>

Ten males currently recovering or previously recovered from severe malnutrition were admitted to these studies after developing acute diarrhea, which was operationally defined as an acute change of stool pattern resulting in semi-liquid or water stools of total quantity greater than 200 g per day. Selected indicators of the nutritional and clinical status of these patients are presented in Table 3. Stool cultures were obtained at the onset of diarrhea, but at the time of these studies our laboratory was capable of identifying only Salmonella and Shigella of the pathogens commonly associated with childhood diarrhea.

The patients were treated with oral or intravenous glucose-electrolyte solutions for 2 to 8 days (mean 4 days) before the formula diet was introduced. Initially the children received the casein formula at a level of 25 Kcal/Kg/day, as described above for children recovering from malnutrition. With each subsequent increase of energy intake of 25 Kcal/Kg/day half of the daily energy was provided by noodles. Thus, at intakes of 50 and 75 Kcal/Kg/day, 25 and 37.5 Kcal/Kg/day, respectively, were supplied by the staple. With further increases in energy consumption the diets were identical to those described for malnourished children in Diet Group 2 (Table 2). The patients received each level of intake for one to three days, depending on stool output, before advancing to the next level. Stool and urine were collected continuously for metabolic balance studies as described above once the patients began receiving the formula diets. Except for one child with a concurrent urinary infection, only the two patients with positive stool cultures received antibiotic therapy while consuming the noodle diets.

In a previous study of the digestibility and utilization of wheat noodles a diet consisting of 50% of energy from the same staple food was provided to children who were free from recent diarrhea and malabsorption and who were well along in their recovery from protein calorie malnutrition (10). The "50% pasta' diet in that study was almost identical to the formulation used in the current studies except that protein provided 6.6% of energy and no casein was added. Thus, the digestibility of that diet in healthy children can be compared to the results from the present studies of children recently recovered from acute diarrhea. In the previous study all children received either 100 or 125 Kcal/Kg/day.

RESULTS

Initial management of malnutrition

The malnourished children uniformly tolerated the diets well and responded to their initial medical and nutritional therapies. The numbers of days that were required to reach each successive level of dietary intake are listed by diet group in Table 4. The findings were almost identical to results from previous patients of similar nutritional status who were treated with casein formulas (3). All but two of the children began to gain weight consistently within 2 weeks of entering the hospital; the two exceptions required 16 and 19 days to demonstrate their recovery. Following an initial modest fall of the serum albumin level, which we have also observed in children receiving milk formulas (11), recovery of the albumin status was demonstrated by the second week in the hospital. None of these findings was significantly different for the two diet groups.

Most children required either 75 or 100 Kcal/Kg/day to demonstrate any gain in weight; one patient, whose fecal fat excretion was greater than 30% of intake did not begin to gain until he received 150 Kcal/Kg/day. The average daily weight gains are presented by level of intake in Table 5, as are the fecal wet and dry weights, absorption and retention of nitrogen, and fecal excretion of energy and fat. Since there were no biologically or statistically significant differences between the two diet groups, their findings are considered together. As the level of intake, and consequently noodles, increased there was a trend toward higher stool wet and dry weights. However, none of the changes was statistically significant ($P>0.05$). Once an intake of 100 Kcal/Kg/day was attained, there were no changes in the absorption of nitrogen; a modest improvement in the retention of nitrogen continued, despite the fact that a greater amount and proportion of the nitrogen were supplied by the staple. It must be recognized, however, that consistent errors in the balance technique make it unreliable to compare the absorption and retention of nitrogen at different levels of intake (12). Following an initial decline in the quantity of fecal total energy and carbohydrate excretion, there was generally increased excretion with increasing levels of dietary consumption. On the other hand the absolute amount of fecal fat excretion remained constant, while the proportion of dietary fat that was excreted declined as greater quantities were consumed.

Dietary management of acute diarrhea

Our approach to the management of acute diarrhea at the time that these studies were completed included a delay in the reintroduction of the formula diets until the excessive stool output and associated signs and symptoms such as vomiting, dehydration, and acidosis had resolved. Possibly, for this reason the formulas were consistently well tolerated at the time of reintroduction. Rapid increase in the level of energy intake was compatible with satisfactory fecal weights and apparent absorptions of macronutrients in almost all cases (Table 6). All of the patients had stool outputs less than 130 g/day while receiving intakes as high as 100 Kcal/Kg/day, except for one patient who had fecal wet weights of 160 and 213 g/day, while receiving 75 and 100 Kcal/Kg/day, respectively. Three of the ten children who received 125 Kcal/Kg/day had stool weights greater than 130 g/day. These findings are similar to data previously reported for healthy children receiving a similar formulation of the same products (10). In no case did the increased fecal weight necessitate a reduction in either the level of intake of total energy or in the proportion of energy provided by the staple.

All but two of the children demonstrated a consistent increase in body weight once they were consuming 75 Kcal/Kg/day. One child required 100 Kcal/Kg/day and the second (whose fecal fat ranged from 24 to 65% of intake from the wheat-containing formula) required 125 Kcal/Kg/day. Although the fecal excretion of nitrogen, energy, and fat tended to increase with higher levels of consumption, when expressed as a percentage of intake, fecal losses generally decreased with increasing energy ingestion. However, at the highest level of intake there was an elevated proportion of wastage of macronutrients from the diets. Nevertheless, even at the highest level of intake the apparent absorption of nitrogen was not different from results observed in healthy children consuming wheat noodles at the same level of intake (10) (83±9% vs 81±3%). Excretion of carbohydrate was was somewhat higher (11.0±8.9 g/day vs 4.2±2.6 g/day). Transient steatorrhea, defined as fecal fat losses of greater than 15% of intake, was seen in a significant number of children, as has been noted previously (13). About two thirds of the higher losses of fecal energy in children recovering from diarrhea (154±135 x 60±13 Kcal/day) could be accounted for by their relatively greater malabsorption of fat (21.4±18.4 vs 7.1±2.7% of intake). Not surprisingly, there was much greater variability in the absorption status of children recovering from diarrhea than was formerly noted among healthy children.

DISCUSSION

Previous studies of the quality of several different wheat products consumed by apparently healthy infants and children convalescent from malnutrition have indicated that the staple can readily provide a substantial proportion of the energy and protein of their diets (10,14,15). Studies of the same wheat noodles at an equivalent proportion of energy, but with 6.6% of energy as protein, indicated that the nitrogen from the noodles was absorbed 96% and retained 51% as well as nitrogen from casein. At that level of consumption there was no significant difference between the absorption of the carbohydrate from the pasta and the absorption of the sucrose and cornstarch of the casein control formula (10).

A more critical test of the ability of a particular food to satisf· nutrients requirements is whether it can be utilized successfully by children who are acutely ill or recently recovered from illness. Numerous studies have demonstrated impaired intestinal function both in protein-calorie malnutrition (16) and during and after acute diarrhea (17). Thus, it was deemed necessary to evaluate directly the utilization of wheat noodles by malnourished children and by patients recovering from diarrhea, rather than extrapolate from the results of earlier work.

The results from the present studies indicate that wheat-casein mixtures promoted the recovery from malnutrition as readily as casein formulas had done previously. These findings justify the use of dietary preparations with reduced concentrations of casein, thus permitting satisfactory nutritional therapy at lower cost. Because of our initial concern regarding the use of a potentially incomplete diet in severely ill patients, the staple was not introduced into the diet until the children were tolerating at least 75 Kcal/Kg/day. We now feel justified in testing wheat-casein mixtures at the moment of introduction of oral feeding; studies to evaluate such therapy are in progress.

A potential limitation of the wheat-casein combination is the lack of availability of the casein isolate in many areas where malnutrition is common. Because of the minimal amount of milk protein that is required to supplement the lysine deficiency of wheat protein, it is conceivable that wheat-whole milk mixtures could be of similar utility despite the common occurrence of some degree of lactose malabsorption. One study from Bangladesh has shown that a limited amount of supplemental milk offered in addition to a diet of rice and vegetables was well tolerated and well absorbed by known lactose malabsorbers (18).

An interesting dichotomy in the ability of the intestine to absorb fat and carbohydrate at increasing levels of intake was observed in the children recovering from malnutrition. The proportional absorption of fat tended to improve with nutritional recovery, as has been observed in other studies (19). However, the absorption of carbohydrates, which was almost complete from the casein diets, was less efficient with increased consumption of staple. Similar findings were observed in the earlier studies of the digestibility of wheat pasta (10). It appears that whereas host factors related to gastrointestinal function were more important in determining the absorption of fat, dietary factors, especially the quantity of consumption, may have determined the efficiency of absorption of carbohydrates.

Studies in several lesser developed countries have demonstrated that the impaired growth rates of children from such areas can be partially explained by the high prevalence of diarrheal disease (20,21). Continued feeding during diarrhea (22) and increased feeding after recovery (23) have been suggested as possible therapeutic interventions to alleviate or eliminate the diarrhea-malnutrition cycle. However, there are few data that demonstrate that commonly available foods can be well tolerated and well absorbed in the quantities recommended. The present studies did not evaluate these recommendations directly, insofar as the formula diets were withheld until the acute disease had abated. Nevertheless, the studies indicate that the wheat noodles can be well utilized during the recovery period. Of concern, however, was the finding that both the absolute and proportional excretion of macronutrients increased at the highest level of dietary intake. These results cast some doubt on whether the above cited recommendations to double children's dietary intake during the convalescent period will, in fact, be possible. More studies will be necessary to resolve this question.

As can be inferred from the large variation in the fecal excretion of energy and fat, a sizeable proportion of the children had steatorrhea following acute diarrhea. These results are in accord with earlier studies of healthy infants receiving milk-based diets (13). Since lactose malabsorption can also persist for variable lengths of time after acute diarrhea (24), it was comforting to learn that the absorption of carbohydrate from the staple food was only slightly less efficient than had been previously observed in healthy children (10).

At the time that these studies were undertaken our laboratory did not have the capability of identifying some of the agents that have been recently recognized as responsible for childhood diarrhea, such as enterotoxigenic E. coli and rotavirus. Therefore, it was not unexpected that the causative infectious agent could be isolated in only two instances. Since different infectious agents operate through a variety of pathophysiologic mechanisms (25), it is possible that some of the heterogeneity of responses to the diet could be explained by the type of infection to which a particular child had been exposed. Further studies will be required to determine the specific interactions among host, infectious agent, and diet.

The present studies indicate that a widely available, low cost staple food can be used successfully in the initial management of malnourished children and in refeeding of healthy children after acute diarrhea. Additional studies will be necessary to determine the minimum concentration of lysine that must be used to supplement the limiting amino acid of the wheat pasta, and to determine whether that supplement could be provided by lactose-containing whole milk. Such mixtures of wheat and milk or milk products will enable wider use of an easily prepared, low cost therapeutic diet for children with diarrhea and/or malnutrition.

FOOTNOTE

[1]These studies were approved by the Joint Committee on Human Investigation, The Johns Hopkins Medical Institutions and the corresponding committee of the Instituto de Investigacion Nutricional, Lima, Peru. Informed consent was obtained from the parents of all children participating in the studies.

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Table 1. Clinical status of malnourished patients on day of admission.

Subject	Age (mos)	Weight (g)	Length (cm)	Weight/Age† (% expected)	Length/Age† (% expected)	Weight/Length† (% expected)	Edema	Albumin (g/dl)	Diagnoses*	Complications
545	10.2	4310	60.7	45.2	82.4	74.3	0	4.00	M	Diarrhea (Salmonella C_1 in feces)
546	16.5	4930	58.7	44.5	73.0	94.1	0	4.17	M	Pneumonia
547	2.8	3670	54.7	70.7	94.2	87.0	0	4.05	M-II	Pneumonia
548	9.5	5560	64.2	60.6	88.8	81.6	+	2.62	M-K	Diarrhea, giardiasis, bacteremia
549	15.5	6640	71.3	61.1	89.8	75.3	0	4.35	M-II	Diarrhea
558	6.0	4050	58.0	51.6	85.5	79.3	0	3.39	M	Abscess, diarrhea
559	10.5	5500	67.0	57.6	91.0	71.5	0	4.08	M	Diarrhea (Shigella B in feces)
565	14.2	6290	72.3	59.0	92.3	69.3	0	3.50	M	Diarrhea
567	10.6	5380	68.3	56.4	92.8	67.4	+	2.69	M-K	U.T.I.
568	23.6	8680	74.9	69.9	86.3	89.5	0	3.10	M-II	
569	12.9	6700	69.1	66.0	90.8	81.0	0	3.36	M-II	Giardia (day 22)
$\bar{x}$	12.0	5610	65.4	58.4	87.9	79.1		3.57		
S.D.	5.5	1434	6.6	8.8	6.0	8.6		0.60		

† Based on the 50th percentile of the NCHS standard.

* Diagnoses: M = Marasmus third degree; M-II = Marasmus second degree; M-K = Marasmic Kwashiorkor using the Gomez Classification (25) and the McLaren score (26).

Table 2. Proximate composition (amt/Kg body weight/day) of diets used in initial treatment of malnourished children.

Level of Intake (Kcal/Kg/d	Dietary Composition	Study Group 1					Study Group 2				
		Amount (g/Kg/d)	Energy (Kcal/Kg/d)	Protein (g/Kg/d)	Fat (g/Kg/d)	CHO (g/Kg/d)	Amount (g/Kg/d)	Energy (Kcal/Kg/d)	Protein (g/Kg/d)	Fat (g/Kg/d)	CHO (g/Kg/d)
25	Pasta*	0					-same as group 1				
	Casein	0.58	2.15	0.50	0.01						
	Oil	1.50	11.88		1.32						
	Sugar	2.75	11.00			2.75					
	Total		25.03	0.50	1.33	2.75					
50	Pasta	0					-same as group 1				
	Casein	1.16	4.30	1.00	0.02						
	Oil	3.00	23.76		2.64						
	Sugar	5.50	22.00			5.50					
	Total		50.00	1.00	2.66	5.50					
75	Pasta	0					7.13	25.03	0.88	0.05	5.25
	Casein	1.74	6.45	1.50	0.03		0.70	2.31	0.62	0.01	
	Oil	4.50	35.64		3.96		4.46	35.32		3.92	
	Sugar	8.25	33.00			8.25	3.09	12.36			3.09
	Total		75.09	1.50	3.99	8.25		74.99	1.50	3.98	8.34
100	Pasta	7.13	25.03	0.88	0.05	5.25	14.26	50.05	1.77	0.10	10.51
	Casein	1.29	4.77	1.11	0.03		0.26	0.96	0.23	0.01	
	Oil	5.95	47.12		5.24		5.92	46.89		5.21	
	Sugar	5.77	23.08			5.77	0.53	2.12			0.53
	Total		100.00	1.99	5.32	11.02		100.02	2.00	5.32	11.04
115	Pasta	14.26	50.05	1.77	0.10	10.51	17.82	62.56	2.21	0.12	13.14
	Casein	0.85	3.15	0.73	0.02		0.33	1.20	0.29	0.01	
	Oil	7.40	58.61		6.51		7.40	58.61		6.51	
	Sugar	3.30	13.20			3.30	0.66	2.64			0.66
	Total		125.01	2.50	6.63	13.81		125.01	2.50	6.64	13.80
150	Pasta	21.39	75.09	2.66	0.16	15.76	-same as group 1				
	Casein	0.40	1.48	0.34	0.01						
	Oil	8.87	70.25		7.81						
	Sugar	0.80	3.20			0.80					
	Total		150.02	3.00	7.98	16.56					

All diets supplemented with sodium (2mEq/Kg/d), potassium (3mEq/Kg/d), vitamins and minerals to meet recommended dietary allowances.

*Composition of noodles varied slightly between lots.

+Amount of oil (cottonseed:soy: 80:20) measured in ml.

Table 3. Nutritional status and clinical data prior to treatment of patients with acute diarrhea.

Subject	Age (mos)	Weight (Kg)	Length (cm)	W/A* %	L/A* %	W/H* %	Alb. (g/dl)	TSS† (g/dl)	Na (mEq/L)	K (mEq/L)	CO^2 (mEq/L)	Dehydration %	Fecal Wet Weight (g/d)	Stool Culture
525	23	9600	73.0	77.4	84.1	102.9	4.00	7.6	134	4.6	17	5	670	Negative
527	13	7850	72.3	75.4	93.6	85.3	2.91	5.6	138	4.8	22	< 5	305	Salmonella C_2
547	7	6050	62.7	72.6	90.2	92.7	4.14	7.0	134	4.8	19	5	260	Shigella B
549	25	9750	80.7	76.3	91.2	87.7	4.48	8.5	134	4.8	19	< 5	270	Negative
553	15	8870	69.2	81.6	87.1	107.3	3.88	5.7	134	5.0	26	< 5	220	Negative
560	16	9680	71.7	87.4	89.1	108.2	3.84	–	134	4.1	15	< 5	650	Negative
561	21	8620	72.6	71.6	85.3	93.6	3.67	9.5	136	4.5	18	5	610	Negative
565	20	9940	76.7	83.9	91.0	97.9	4.05	6.3	136	4.8	21	< 5	940	Negative
570	28	7930	71.8	59.5	79.1	87.3	3.96	7.1	136	4.1	17	< 5	720	Negative
571	13	6580	68.5	63.2	88.7	81.0	3.61	6.8	136	4.1	17	5	700	Negative
$\bar{x}$	18.1	8487	71.9	74.9	87.9	94.4	3.9	7.1	135	4.6	19		534	
S.D.	±6.4	±1367	±4.8	±8.7	±4.2	±9.4	±0.4	±1.3	±1	±0.3	±3		±250	

*Percentage expected weight for age (W/A), length for age (L/A), and weight for height (W/H) compared to NCHS reference population.

†Total serum solids as measured by the hand-held refractometer.

Table 4. Early recovery with casein-wheat diets

	Group I (n=5)	Group II (n=6)	All (n=11)	Formula Treated Infants with M or MK (n=35) (3)
Days required to reach intake of:				
25 Kcal/Kg/d	3.0±2.1	2.3±0.8	2.6±1.5	3.5±5.1
50 Kcal/Kg/d	4.4±2.3	4.3±1.2	4.4±1.7	5.1±5.3
75 Kcal/Kg/d	6.2±3.0	7.8±1.3	7.1±2.3	7.9±5.1
100 Kcal/Kg/d	9.8±3.1	10.8±1.3	10.4±2.2	10.5±6.0
125 Kcal/Kg/d	14.0±4.8	14.0±1.4	14.0±3.2	14.7±6.9
150 Kcal/Kg/d	20.2±7.5	19.0±1.4	19.8±6.1	-
Days required to begin consistent weight gain	10.2±3.8	11.3±4.8	10.8±4.2	
Serum Albumin (g/dl)				
Day 1	3.84±0.69	3.35±0.46	3.57±0.60	
Day 5 - 11	3.65±0.38	3.33±0.50	3.47±0.46	
Day 12-18	3.75±0.19	3.45±0.36	3.58±0.32	
Day 19-25	3.85±0.26	3.34±0.43	3.60±0.43	

Table 5. ..., fecal weight, apparent absorption and retention of nitrogen, and fecal excretion of energy, fat and carbohydrate by level of dietary intake in children recovering from malnutrition

Level of Energy Consumption (Kcal/Kg/d)	D[illegible]	Fecal Weight g/day		Nitrogen			Fecal Excretion					
		Wet	Dry	Intake mg/d	Absorp %	Reten %	Energy Kcal/d	Energy % intake	Fat g/d	Fat % intake	CHO g/d	CHO % intake
	x̄	x̄ ± SD	x̄ ± SD	x̄ ± SD	x̄ ± SD	x̄ ± SD	x̄ ± SD	x̄ ± SD	x̄ ± SD	x̄ ± SD	x̄ ± SD	x̄ ± SD
50 (n=6)	3.[illegible]	63±59	10.0± 6.6	942±216	70.0±16.9	9.7±24.4	65±45	10.8±10.5	5.5±3.4	31.6±18.3	1.2±2.1	3.1±4.8
75 (n=11)	3.[illegible]	70±44	9.2± 4.8	1272±311	79.1± 5.9	19.9±17.7	59±38	14.3± 7.1	4.9±3.7	22.0±13.4	1.1±1.2	2.5±2.8
100 (n=11)	3.[illegible]	66±48	11.0± 7.5	1707±430	82.9± 7.5	27.9± 9.4	68±48	12.7± 7.9	4.4±3.2	15.2±10.6	3.7±3.8	6.2±5.9
125 (n=11)	6.[illegible]	88±63	15.6±11.8	2152±563	81.7± 6.2	27.6± 6.3	94±69	17.1±12.7	5.6±4.0	15.3±10.6	6.7±7.4	8.8±8.8
150 (n=7)	5.[illegible]	116±90	18.2±15.1	2478±580	82.3± 7.8	31.4± 7.1	103±93	12.5± 9.7	5.5±5.8	12.3±11.5	8.6±7.4	9.5±7.2
175 (n=2)	3.[illegible]	76±27	14.4± 3.9	2524±555	84.0± 5.7	39.0± 1.4	75±24	10.0± 5.0	3.1±1.1	8.0± 4.3	7.7±2.9	9.4±5.4

Table 6. Rate of weight gain, fecal weight, apparent absorption and retention of nitrogen, and fecal excretion of energy, fat and carbohydrate by level of dietary intake in children recovering from acute diarrhea.

Level of Energy Consumption (Kcal/Kg/d)	Days on Diet	Weight Gain g/Kg/d	Fecal Weight g/day		Nitrogen			Fecal Excretion						
								Energy		Fat			CHO	
			Wet	Dry	Intake mg/d	% Intake	% Retent	Kcal/d	% Intake	(g/d)	% Intake	No with Steat-orrhea*	g/d)	% Intake
	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD		$\bar{x}$ ± SD	$\bar{x}$ ± SD
25 (n=10)	1.6±0.7	-23.3±12.0	81±68	5.7± 1.7	654± 98	71.0±16.5	26.0±14.1	25± 8	11.9± 6.7	1.8±0.9	16.0± 9.1	5	1.0±0.9	5.1±4.9
50 (n=10)	1.9±0.6	- 5.2± 5.4	38±22	6.8± 3.8	1342±232	87.9± 4.6	18.5±17.9	41± 24	11.5± 8.9	2.7±2.3	11.8±12.4	3	2.7±2.6	7.8±8.5
75 (n=10)	2.1±0.3	2.3± 3.9	57±44	12.1± 9.8	1917±274	86.9± 5.7	21.1± 8.5	66± 71	11.3±13.2	4.6±5.9	14.3±18.2	2	3.9±3.7	6.7±6.2
100 (n=10)	2.5±0.7	5.9± 3.2	71±55	15.2±10.9	2510±363	86.8± 5.6	31.3±10.4	85± 81	10.6±10.6	5.1±5.9	12.1±15.1	2	6.2±6.1	7.6±7.7
125 (n=10)	3.0±1.7	6.8± 3.1	125±74	26.1±18.5	3102±480	83.3± 9.4	27.3±10.4	154±135	14.7±10.0	10.0±8.7	21.4±18.4	4	11.0±8.9	10.4±7.3

*Steatorrhea defined as fecal fat >15% of fat intake