EFFECT OF AN INTEGRATED CHILD NUTRITION INTERVENTION ON THE COMPLEMENTARY FOOD INTAKE OF YOUNG CHILDREN IN RURAL NORTH VIET NAM*

Helena Pachon, Dirk G. Schroeder, David R. Marsh, Kirk A. Dearden, Tran Thu Ha, and Tran Thi Lang

Abstract

Forty-two percent of Vietnamese children are stunted by two years of age. Since 1990, Save the Children Federation/US (SC) has implemented integrated nutrition programs targeting young children. WE evaluated the effect of SC's nutrition program on the complementary food intake of young rural Vietnamese children Using a longitudinal, prospective, randomized design, we followed 238 children (119 each from intervention and comparison communes) age 5 to 25 months old for six months with a re-survey at 12 months. We gathered 24-hour recall data at baseline and at months 2, 4, 6, and 12. Dietary energy intake was calculated using the 1972 Vietnamese food composition table. Key outcomes were daily frequency of consuming intervention-promoted food and non-breastmilk liquids and food, daily quantity of non-breastmilk liquids and food consumed, daily energy intake, and proportion of children meeting daily median energy requirements. Young rural children exposed to SC's program consumed intervention-promoted, and any, foods more frequently, ate a greater quantity of any food, consumed more energy, and were more likely to meet their daily energy requirements than comparison children. Some effects were only observed during the intensive intervention period; others persisted into or were evident only at the 12 months follow-up, approximately four months after program completion. Based on the mothers' reports, the intervention did not apparently compromise breastfeeding prevalence or frequency. The intervention improved children's food and energy intake and protected them from declining as rapidly as comparison children in meeting their energy requirements.

Key words: nutrition, complementary food, complementary feeding, diet, dietary intake, intervention, infant feeding, Viet nam

Introduction

Forty-two percent of Vietnamese children are stunted by two years of age [1]. Stunting in early life leads to impaired immune function, increased rates and severity of infection, delayed motor development, and impaired cognitive function and school performance [2]. Dietary interventions targeted at infants 6 to 12 months old can improve energy intakes and growth [3]. Further, data from Guatemala suggest that interventions targeted at younger children (less than 2 to 3 years old) have the greatest nutritional impact [4].

Since 1990 Save the Children (SC) has implemented integrated nutrition programs, based on the positive deviance approach, to reduce sever childhood malnutrition by approximately 75% [5]. The improvement in children's nutrition had been rapid (within the first year of implementation) permitting SC to move on to other program sites; and the impact was also long lasting. In a recent study [6], children who participated in the program were significantly better nourished than children who did not two years after SC left the program area. In addition, the younger siblings of these children, born after the program ceased, were much better nourished than the younger siblings of children from comparison communes.

In this paper we report findings from the Vision (viet Nam study to improve outcomes in nutrition) project, a rigorous evaluation of SC's integrated nutrition program in rural north Viet Nam. Specifically, the effect of SC's program on young children's intake of complementary foods is presented.

Helena Pachon, formerly at the Rollins School of Public Health, Emory University, Atlanta, Ga., USA, is now affiliated with the Division of Nutritional Sciences at Cornell University in Ithaca, NY. Dirk G. Schroeder is affiliated with the Rollins School of Public Health at Emory University, in Atlanta Ga., USA. David R. Marsh is affiliated with Save the Children Federation/US in Westport, conn., USA. Kirk A. Dearden, formerly at the LINKAGES Project, Academy for Educational Development, Washington, D.C. is now at the Department of Health Science, Brigham Young University in Provo, Utah, USA. Tran Thu Ha is affiliated with the Research and Training Center for Community Development in Hanoi, Viet Nam. Tran Thi Lang was formerly affiliated with Save the Children Federation/ US in Hanoi, Viet Nam.

* The Vision (Viet Nam study to improve outcomes in nutrition) Project evaluated the implementation and impact of an integrated nutrition program on the nutritional status, morbidity, diet of, and care for children 5 to 25 months old at baseline in rural Viet Nam, through a partnership among Save the Children/ US (Hanoi and Westport, conn., USA), the USAID-funded LINKAGES Project (Washington, D.C.), Emory University's Rollins School of Public Health (Atlanta, Ga., USA), and the Research and Training Center for Community Development (Hanoi).

Methods

The Intervention

Details of the program implementation are presented elsewhere [7]. Briefly, the positive deviance approach was used to identify positive deviant children who were well nourished yet came from resource-poor families [8]. Families of positive deviant children were interviewed regarding their feeding and caregiving practices [9]. These interviews were analyzed to identify the key foods and behaviors that were thought to explain the good nutritional status of positive deviant children. Information gathered also informed the content of two-week long nutrition education and rehabilitation sessions that were modeled after the hearth approach originally developed in Haiti [5, 10]. Malnourished children and their caregivers participated in intensive nutrition rehabilitation sessions that lasted two weeks per month and continued for up to nine months. Furthermore, all children less than three years of age participated in growth monitoring and promotion sessions every other month for two years and were dewormed once during the first six months of the program. Messages promoted at the growth monitoring and at the nutrition rehabilitation sessions included feeding children "good foods" (i.e., positive deviant foods) identified during the interviews with positive deviant families, increasing the quantity of foods given to children, feeding 5 to 6 times per day, continued breast-feeding, and health-seeking and other caring behaviors not evaluated in this paper.

Study setting, randomization, and enrollment.

This study was carried out in a rural province northwest of Hanoi characterized by subsistence farming and poverty. Details on selecting the study setting, randomization, and enrollment are provided elsewhere [7]. In brief, we identified 12 communes, paired them on common attributes that were though to have been potential confounders of the associations under study (e.g., malnutrition level, ethnicity, rice production, ecology) [7], and randomly assigned one of each of the six resulting pairs for the intervention and the other for comparison. Among the commune hamlets with the largest proportion of malnourished children (as determined by weight-for-age Z score less than –2), 120 children 5 to 25 months old were randomly selected from the intervention communes and another 120 children were randomly selected from the comparison communes. We dewormed all intervention and comparison children.

Measurement of outcomes

Beginning in December 1999, we used a longitudinal, prospective design to gather 24-hour dietary recall data at baseline and months 2,4,6, and 12 of the study. Data collection spanned the rainy and dry seasons (February to July and August to January, respectively). The form was used to gather children's dietary intake and breastfeeding status and frequency from their caregivers. The form was based on 24-hour recall forms used by the National Institute of Nutrition (NIN) in Viet Nam, The Instituto Nacional de Salud Publica in Mexico, and the Instituto de Nutricion de Centro America y Panama in Guatemala and were pre-tested in Viet Nam. A doctoral-level nutritionist from the NIN trained four field workers and two supervisors in gathering, calculating, and coding the data, supervised the pre-test, and provided guidance and feedback as requested. The field workers and supervisors, affiliated with the Research and Training Center for Community Development (RTCCD) in Hanoi, were physicians and sociologists with previous experience collecting health data in rural Viet Nam.

Soehnle Attache Gram scales (Montlingen, Switzerland) with 2-kg capacity and 1-g and 2-g precision for items weighing less than 1 kg, and 1 to 2 kg, respectively were used to measure non-breastmilk foods and liquids consumed by children using the household bowls, cups and utensils in which they were served. When foods could not be weighed, estimates were derived using household bowls, cups, and utensils and NIN-developed, portion-size photos for commonly consumed foods.

The food composition table officially recognized by the NIN, published in 1972, was used for all analyses [11]. When foods consumed could not be found in the food composition table, a food in the table most closely resembling this food was substituted. Some commercially processed foods were added to the food composition table using the nutrient information printed on the labels.

During household visits, field workers interviewed the caregiver(s) who had fed the child the previous day. If a child was fed outside the home, we sought to identify and converse with the person (s) who prepared the food and fed the child. In a 45-minute visit during months two and four, the field worker collected data on several parameters such as anthropometry and morbidity and spent approximately 30 minutes of this time collecting the dietary intake information. During months 0, 6, and 12, additional form were applied. Over the course of a two-week field rotation, each field worker visited approximately four homes daily, seven days a week.

Daily meal times were reported by caregivers and could include at least seven meals or feeding times: snacks consumed before breakfast, breakfast, snacks consumed between breakfast and lunch, lunch, snacks consumed between lunch and dinner, dinner, and snacks consumed after dinner.

Current breastfeeding status was determined by asking the caregiver if the child breastfed at all on the previous day. Breastfeeding frequency was calculated based on the number of breastfeed reported by caregivers during the 24-hour period of interest.

Every evening and with supervisor support, the field workers completed calculations (i.e., net grams consumed by children) by hand and entered these on the dietary recall form. Supervisors reviewed all form and discussed and discrepancies on a daily basis. If necessary and

logistically feasible, households were re-visited to reconcile these discrepancies.

Data were entered and cleaned by the RTCCD in Hanoi using Epi Info [12]. Further checks were run at Emory University and shared with the RTCCD staff who reviewed original forms and updated the data as needed.

This study was approved by the Emory University Human Investigations committee. Written informed consent was obtained from the household head during the first home visit.

Data analysis

The impact of the intervention on dietary intake was evaluated during two periods: at months 2, 4, and 6 combined which correspond to the intensive Save the Children program period and at month 12 (follow-up) which was approximately four months after the program was completed. As such, the ViSION project and the SC program overlapped during seven of the nine months of the SC program, corresponding to months 0 to 6 of the ViSION project. The baseline and follow-up data correspond to the dry season and the intensive period corresponds to the wet season.

We created a socioeconomic status composite variable using factor analysis within SAS [13] considering the interviewee's self-reported standard of living, electricity access, house construction material, and interviewer's assessment of the family's socioeconomic status. We used Epi Info version 6.04b [12] to create anthropometric Z scores using the NCHS/WHO/CDC reference values and other sociodemographic and outcome variables. To evaluate a child's energy intake relative to median requirements, we used age-and breastfeeding-specific kcal per kg requirements, for breastfeeding and non-breastfeeding children 6 to 24 months old originally developed by WHO [2] and later revised by Dewey and Brown [14]. For breastfed children, average breastmilk intake was assumed. For children older than 24 months, sex-and age-dependent requirements published by King and Burgess [15] were used. For five-month-old children (n=3), energy requirement for six-month-old children were used.

Univariate and bivariate analysis were carried out using Stata version 6.0 [16]; non-normally distributed data were transformed prior to carrying out analyses. A *p* value less than or equal to .05 was considered statistically significant.

Results

Sample characteristics

Two hundred and forty-one children were enrolled in the study at baseline, including three children younger than five months or older than 25 months of age who were excluded from these analyses (table1). Of the remaining 238 participants, five dropped out during the course of the study and another six could not be located for the month 12 follow- up.

At baseline children were 15.5 months old on average, more than one-third were stunted, and most were breastfeeding (table 1). Participant mothers were about 26 years old, almost one-quarter of them were malnourished (BMI less than 18.5 kg/m2), about half did not complete secondary school, and most had two or fewer children and were farmers. Despite attempts to control for important confounders through matching, intervention families were significantly more likely than comparison families to have fewer children and significantly less likely to have wasted children.

Almost half (44%) of the intervention children participated in the nutrition education and rehabilitation sessions (NERPs) at least one time during the seven-month period during which the current study and the Save the Children program overlapped. These children attended NERPs an average of 4.5 months each, i.e., 4.5 two-week nutrition and education rehabilitation sessions.

TABLE 1. Characteristics of the sample at baseline

	Intervention[a] (n=119)	Comparison[a] (n=119)
Characteristics of the child		
Age (mo)	14.9 ± 5.1	15.1 ± 5.1
Sex, females (n,%)	52 (43.7%)	59 (49.6%)
Weight (kg)	8.3 ±1.3	8.2 ± 4.7
Height (cm)	73.4 ± 5.1	73.4 ± 4.7
Weight-for-age <-2 Z (n,%)	36 (30.3%)	42 (35.3%)
Height-for-age <-2 Z (n,%)	42(35.3%)	51(35.3%)
Weight-for-height <-2 Z (n,%)	***2 (1.7%)	12(10.1%)
Currently breastfeeding (n,%)	86 (72.3%)	78 (65.5%)
Characteristics of the mother		
Age (yr)	26.2 ± 4.7	26.9 ± 5.4
Body mass index<18.5 (n,%)	29 (24.4%)	28 (23.5%)
Less than secondary school (n,%)	56 (47.1%)	68 (57.1%)
≤ 2 children (n, %)	*104 (87.4%)	93 (78.2%)
Occupation, farmer (n, %)	111 (93.3%)	114 (95.8%)
Characteristics of the family		
Yearly income, x 1000 dong [b]	6,527.0 ± 7,109.5	6,777.7± 6,391.9
Socioeconomic status	-0.01 ± 1.03	0.04 ± 1.15

a All values are mean ± SD unless indicated (n,%) in column 1.

b US$1 = 14,025 Vietnamese dong.

* p ≤.10, *** p ≤ .01.

Impact on food intake

Communes promoted locally identified positive deviant foods (tables). The most commonly identified positive deviant food was crab (identified in all six intervention communes). During the intensive intervention period, intervention children consumed positive deviant foods more frequently than comparison children (table 3). In particular, peanuts, sesame seeds, and tofu were consumed approximately three times more frequently by the intervention children than by the comparison children (data not show).

NERP messages included encouraging caregivers to increase the quantity of food fed to the child. At baseline, intervention children consumed a slightly greater (262.2 vs. 243.5 g, not statistically significant) daily quantity of any food (i.e., not only positive deviant food) as compared to comparison children (table 3). This difference increased during the intervention and was sustained, such that intervention children consumed 20% or 70g per day more (409.8 vs. 340.3 g, $p \leq .01$) than comparison children at month 12.

During the NERP sessions, caregivers were also encouraged to at least five to six times per day. Intervention children received comparison children throughout the study, especially during t and 12-month follow-up when the difference represented one 11% more feedings (4.9 vs. 4.4 feedings, $p \leq .01$) (table 3).

TABLE 2. The number of intervention communes promotir deviant foods.

Positive deviant food	Communes Promoting (n = 6)
Crab	6
Fish	5
Fruit	5
Peanut	5
Sesame seed	5
Vegetables	5
Eggs	4
Shrimp	4
Tofu	4
Beans	3
Cassava	3
Meat	3
Potatoes	3
Rice	3
Snail	3
Clams	2
Corn	2
Sweet potatoes	2
Bananas	1
Green vegetables	1
Oranges	1
Papaya	1
Starches	1
Tangerines	1

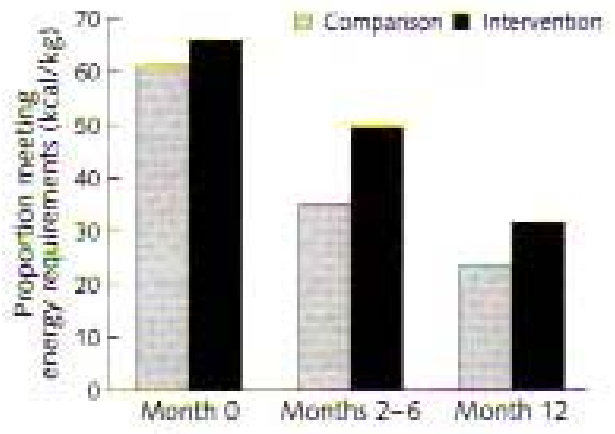
TABLE 3. Daily complementary feeding and breastfeeding practices of children in the intervention and comparison groups at baseline, during the intensive intervention (months 2 to 6) and at the month 12 follow-up[a]

	Month 0		Months 2-6		Month 12	
	Comparison (n = 119)	Intervention (n = 119)	Comparison (n = 119)	Intervention (n = 119)	Comparison (n = 115)	Intervention (n = 112)
Frequency of consuming positive deviant foods (times per day)	4.2 ± 1.8	4.3 ± 2.0	3.6 ± 1.1 **	4.1 ± 1.7	.7 ± 1.4	3.8 ± 1.6
Quantity of food consumed (g)	243.5 ± 168.4	262.2 ±197.0	254.4 ± 134.0 **	299.7 ±155.2	340.3 ± 167.5 ***	409.8 ± 197.4
Meal time frequency (per day)	4.4 ± 1.6	4.6 ± 1.8	4.2 ± 1.0 ***	4.6 ± 1.3	4.4 ± 1.5	4.9 ± 1.5
Energy intake (kcal)	596.6 ± 363.4	629.2 ± 386.9	597.4 ± 275.7 *	662.7 ± 301.0	718.4 ± 330.0 ***	826.9 ± 324.4
Proportion met energy (kcal/kg) requirements	62.2%	66.4%	35.1 % ***	49.0 %	23.5 %	31.3 %
Breastfed previous day	65.5%	72.3 %	47.8 %	51.3 %	13.9 %	13.4 %
Breastfeeding frequency	7.9 ± 3.1 **	7.0 ± 2.9	8.8 ± 2.9	9.3 ± 3.3	6.5 ± 3.0	6.0 ± 3.0

a All values are mean (± SD) unless indicated "%"
* $P \leq .10$; *** $P \leq .01$.

Impact on energy intake

Did improvements in food intake translate into improvements in energy intake? As expected, daily energy intake generally increased for all children over time as they aged and grew (table 3). Intervention children consumed more energy than comparison children at all three study points, reaching statistical significance only at the 12- month follow-up. Similarly, more intervention than comparison children met their median energy requirements (kcal/kg) throughout the study although the proportion in both groups decreased over time (table 3, fig. 1). The difference was greatest during the intensive intervention period when nearly 40% more intervention than comparison children met their requirements (49.0% vs. 35.1%, $p \leq .001$). The intervention children most likely to meet their requirements were younger, malnourished children (15 months or younger with a WAZ less than –2 at baseline) and older well-nourished children (over 15 months with a WAZ –2 or greater at baseline) (table 4).



.

FIG. 1. The proportion of children in the intervention and comparison groups who met their daily median energy requirement (kcal/kg) at baseline, during the intensive intervention (months 2 to 6) and at the month 12 follow-up

Impact on breastfeeding

Continued breastfeeding through 24 months was promoted through the intervention. Although there was a decline over time in the proportion of children breasfeeding, there were no differences between the intervention and comparison groups in the reported breastfeeding prevalence during all three study points (table 3). At baseline, comparison children were reportedly breastfed with greater frequency (by about 1 breastfeed) in the preceding 24-hour period than intervention children. Between baseline and the intensive intervention, intervention children had a greater increase in breastfeeding frequency than comparison children (2.53 vs. 1.02, $p \leq .05$) (fig. 2). There was no statistically significant difference in the change in breastfeeding frequency from baseline to the month 12 follow-up between these intervention and comparison children

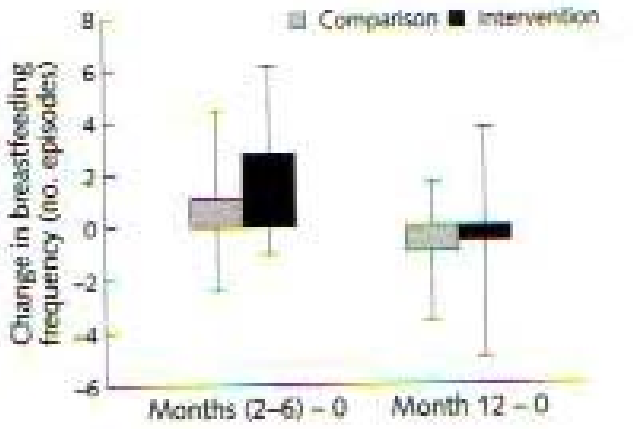


FIG. 2. Changes in the intervention and comparison groups in breastfeeding frequency between the intensive intervention (months 2 to 6) and baseline and between the month 12 follow-up and baseline

TABLE 4. The proportion of children who met their daily median energy requirement (kcal/kg) stratified by age and weight-for-age Z score at baseline.

Age and WAZ at baseline	Month 0		Months 2 - 6		Month 12	
	Comparison (n = 119)	Intervention (n = 119)	Comparison (n = 119)	Intervention (n = 119)	Comparison (n = 115)	Intervention (n = 112)
≤ 15 mo and WAZ < -2	84.2%	93.8%	44.6%**	68.8%	50.0%	46.7%
≤ 15 mo and WAZ > -2	66.7%	71.8%	39.4%	48.3%	40.0%	55.3%
>15 mo and WAZ < -2	60.9%	60.0%	31.9%	42.4%	4.4%	15.8%
>15 mo and WAZ ≥-2	50.0%	50.0%	29.6%***	45.2%	11.4%	10.0%

** P≤ .05; *** P ≤ .01

Discussion

Young rural children exposed to Save the Children's integrated nutrition program in northern Viet Nam consumed positive deviant and other complementary foods more frequently, ate a greater quantity of any complementary food, consumed more energy requirements from complementary food than a comparison group of children. Younger, malnourished (15 months old or younger with a WAZ less than –2 at baseline) and older, well-nourished (older than 15 months of age with a WAZ –2 or greater at baseline) intervention children were more likely to meet energy requirements from complementary foods than comparison children. Some of these effects were only observed during the intensive intervention period while others persisted into or were evident only at the 12-month follow-up. The proportion of children breastfeeding and the frequency of breastfeeds were not affected by the intervention.

Energy

Although breastfeeding practices among Vietnamese children have been published [17,18], we are unaware of any studies that have examined similar dietary out-comes among young Vietnamese children. However, an analysis of programs directed at improving intakes among infants 6 to 12 months old in developing countries reported improvements in total caloric intake between 71 and 164 kcal per day [3]. Our intervention infants 5 to 12 months old at baseline consumed an average of 49 kcal per day more than comparison children at the 12 month follow-up (data not shown), somewhat lower than in these other programs.

There was a 108.5 kcal per day difference between intervention and comparison children at month 12. For breastfed or non-breastfed children 6 to 24 months of age, this represents 19% to 53% or 12% to 17% of median energy requirements, respectively. Thus, the improvements in energy intake observed among the intervention group contributed importantly to children's energy intakes.

Although children augmented their energy intake over time, increasingly children failed to consume enough to meet their weight-based requirements. At the 12 month follow-up, fewer than half of all children met their median energy requirement indicating that energy is limiting in the children's diets.

A greater proportion of younger, malnourished intervention children met their energy requirements than younger, malnourished comparison children. A similar finding was observed for older well-nourished children. In the case of younger, malnourished children, the intervention children seemed to be better off at baseline (not statistically significant) and continued to be better off during the intensive intervention. These two subgroups of intervention children also had greater improvement in WAZ than their comparison counterparts [19]. Perhaps these more active children took better advantage of improved household food availability than their counterparts who did not grow as rapidly, even when exposed to the same intervention.

The effects of the intervention on dietary outcomes were less than expected for several reasons. The intervention children were less malnourished (WHZ) at baseline than the comparison children, thus the intervention children had less potential to improve than the comparison children. In addition, the implementation of a sample of observed NERPs deviated from, the standard protocol in important ways that may have limited the NERPs' ability to change behavior [20]: NERP attendance, caregiver contributions, caregiver participation in food preparation, and health message delivery by volunteers were all lower than expected. In some cased, food was "delivered" to children's homes, but we do not know if the children actually consumed the food. Finally, the concept of positive deviant food was not fully understood by program implementers. For example, positive deviant food should be specific, nutritious, and uncommonly consumed. Many of the foods promoted as positive deviant did not meet those guidelines (e.g., meats, fruit, and vegetables are non-specific; starches have limited nutritive value; and rice is eaten universally)

Breastfeeding

A concern with interventions to improve complementary food intakes, among young children is the negative effect they can have on breastmilk intake [21, 22]. Based on reported recall by mothers, we detected no negative effect on breastfeeding prevalence and a positive effect on breastfeeding frequency.

The intervention

We found that the program was fairly effective in identifying nutritious positive deviant foods. Through the intensive rehabilitation (NERP) sessions and growth monitoring, the importance of feeding these positive deviant foods was apparently delivered and put into practice by caregivers whose children ate more of these foods than did children in comparison communes.

Behavior-change theory would favor the NERPs as being the primary route for the change in complementary feeding practices observed in the intervention children because they offer the opportunity to modify many behavioral determinants [23]: skills for preparing nutritious meals, with locally available positive deviant foods, self-efficacy through participation in preparing and feeding meals, norms about what is considered a healthy child, a normal diet, and a normal serving, and knowledge regarding affordable and locally available nutritious foods.

Limitations

For analyses, we used the official Vietnamese food composition table published in 1972. Because techniques for calculating the energy content of foods have not

changed considerable in the past 30 years, the use of energy values from the 1972 table is not likely to underestimate children's energy intake.

In using the breastfeeding-specific kcal per kg requirements, we were unable to accurately assess and categorize children's breastmilk intake as low, average, or high and thus used average for all children. Subsequently, we may have under – or overestimated children's energy requirements. Since we do not have information on the amount of food *served* to children or their micronutrient status, we were unable to evaluate the role of micronutrient deficiencies on children's appetite and the effect of appetite on food intake.

Lessons learned

Future effectiveness studies of dietary interventions to improve complementary feeding should include a process evaluation, as we have done, to detail programs implementation. These data are useful in understanding how program components were implemented and could have affected the main outcomes of interest. Further, breastmilk intake should be quantified on a subset of children by weighing them before and after breastfeeds to better assess impact of the intervention on this parameter.

Programmatic implications

Save the Children's program primarily promoted four behaviors: the consumption of positive deviant foods, an increase in the quantity of foods given to children, feeding five to six times per day, and continued breastfeeding. The program was successful in increasing the first three behaviors, which resulted in improvements in energy intake. No concomitant increase (or decrease) was seen in breastfeeding prevalence due to the intervention. These findings suggest that the program was successful. On the other hand, process evaluation data indicate that program implementation was often not according to protocol. In future iterations, of the program, greater attention should be placed on faithful implementation of the protocol. This will likely enhance the positive effects observed here. Further, the feeding frequency message should be updated to reflect age- and breastfeeding-specific recommendation [2].

Conclusions

We have documented that a positive deviance-informed program coupled with intensive feeding sessions can have positive effects on dietary intakes among young children in Viet Nam. Although the program was not exactly implemented as planned, children exposed to the intervention had improved complementary feeding intakes while breastfeeding practices were not negatively affected. These generally positive results provide evidence that improved diet is an important mechanism on the causal pathway to the observed better growth seen with positive-deviance informed programs.

Acknowledgments

We thank Debbie Humphries for providing us with electronic and print copies of the 1972 and 1995 Vietnamese food composition tables and Le Cong Binh for assistance with coding foods in the food composition table. This research was supported by the LINKAGES: Breastfeeding. LAM, Complementary Feeding, and Maternal Nutrition Program. LINKAGES is supported by G/PHN/HN, Global, the United States Agency for International Development (USAID) under the terms of Grant No. HRN-A-00-97-00007-00 and is managed by the Academy for Education Development. The opinions expressed herein are those of the authors and do not necessarily reflect the views of USAID.

Reference

1. NIN/UNICEP. National vitamin A deficiency and protein-energy malnutrition prevalence survey. Hanoi: National Institute of Nutrition and UNICEP, 1999.
2. World Health Organization. Complementary feeding of young children in developing countries: A review of current scientific knowledge. Geneva: WHO, 1998.
3. Caulfield LE, Huffman SL, Piwoz EG. Interventions to improve intake of complementary foods by infants 6 to 12 months of age in developing countries: Impact on growth and on the prevalence of malnutrition and potential contribution to child survival. Food Nutr Bull 1999; 20(2): 183-200.
4. Schroeder DG, Martorell R, Rivera JA, Ruel MT, Habicht JP. Age differences in the impact of nutritional supplementation on growth. J Nutr 1995;125:1051S-9S.
5. Wollinka O, Keeley E, Burkhalter BR, Bashir N, eds. Hearth nutrition model: Applications in Haiti, Viet Nam and Bangladesh. Arlington, Va., USA: BASICS, 1997.
6. Mackintosh UAT, Marsh DR, Schroeder DG. Sustained positive deviant child care practices and their effects on child growth in Viet Nam. Food Nutr Bull 2002;23 (4suppl): 18-27.
7. Marsh DR, Pachon H, Schroeder DG, Ha TT, Dearden KA, Lang TT, Hien ND, Tuan DA, Thach TD, Claussenius DR. Design of a prospective, randomized evaluation of an integrated nutrition program in rural Viet Nam. Food Nutr Bull 2002;23 (4 suppl): 36-47.
8. Zeitlin M. Nutritional resilience in a hostile environment: Positive deviance in child nutrition. Nutr Rev 1999;49 (9): 259-68.
9. Sternin M, Sternin J, Marsh DR. Designing a community-based nutrition program using the hearth model and the positive deviance approach: A field guide. Westport, Conn., USA: Save the children Federation/US. 1998.
10. Bolles K, Speraw C, Berggren G, Lafontant JG. Ti Foyer (health) community-based nutrition activities informed by the positive deviance approach in Leogane, Haiti: A programmatic description. Food Nutr Bull 2002;23 (4 suppl): 11-17.
11. National Institute of Nutrition. Food products in Viet Nam: Composition and nutritive value. Hanoi: NIN, 1972.
12. Dean AG, Dean JA, Coulombier D, Brendel KA, Smith DC, Burton AH, Dicker RC, Sullivan K, Fagan RF, Arner TG. Epi Info, version 6: A word processing, database, and statistics program for epidemiology on IBM-compatible microcomputers. Atlanta, Ga., USA: Centers for Disease Control and Prevention, 1995.
13. SAS Institute, Inc. SAS statistical software. Cary, N.C., USA: SAS Institute,1998.
14. Dewey KG, Brown KH. Update on technical issues concerning complementary feeding of young children in developing countries and implications for intervention programs. Geneva: WHO, 2002.
15. King FS, Burgess A. Nutrition for developing countries, 2nd edition. Oxford: Oxford University Press 1993.
16. Stata Corporation. Stata: Statistics/ data analyst. College Station, Tx., USA: Stata Corporation, 1999.
17. Nga NT, Weissner P. Breast-feeding and young child nutrition in Uong Bi, Quang Ninh Province, Vietnam. J Trop Pediatr 1986;32:137-9.
18. Hop LT, Gross R, Giay T, Sastroamidjojo S, Schultink W, Lang NT. Premature complementary feeding is associated with poorer growth of Vietnamese children. J Nutr 2000;130:2683-90.
19. Schroeder DG, Pachon H, Dearden KA, Ha TT, Lang TT, Marsh DR. An integrated child nutrition intervention improved growth of younger, more malnourished children in northern Viet Nam. Food Nutr Bull 2002;23(4 suppl): 53-61.
20. Dickey VC, pachon H, Marsh DR, Lang TT, Claussenius DR, Dearden KA, Ha TT, Schroeder DG. Implementation of nutrition education and rehabilitation programs (NERPs) in Viet Nam. Food Nutr Bull 2002;23 (4 suppl): 78-85.
21. Dewey KG. The challenges of promoting optimal infant growth. J Nutr 2001;131: 1879-80.
22. Bhandari N, Bahl R, Nayyar B, Khokhar P, Rohde JE, Bhan MK. Food supplementation with encouragement to feed it to infants from 4 to 12 months of age has a small impact on weight gain. J Nutr 2001;131;1946-51.
23. Green LW, Kreuter MW. Health promotion planning: An educational and environmental approach. 2nd ed. Mountain View, Calif., USA: Mayfield Publishing Company, 1991.