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# Maternal Feeding Behavior and Child Acceptance of Food during Diarrhea, Convalescence, and Health in the Central Sierra of Peru

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## ABSTRACT

Feeding patterns by mothers and child acceptance of food were measured in a Peruvian village to determine changes on days when children had diarrhea as compared to days of convalescence and health. Morbidity surveillance identified 40 children, aged 4–36 months, with diarrhea. Children were followed using twelve-hour in-home structured observations during two to four days each of diarrhea, convalescence, and health. Using scales of maternal encouragement to eat and child acceptance of food and cumulative logistic regression analyses, maternal encouragement to eat decreased significantly during convalescence compared to diarrheal days (OR: 0.54, 90% CI: 0.35, 0.82) and health compared to diarrhea (OR: 0.65, 90% CI: 0.46, 0.93). In contrast, child acceptance of food increased during health compared to diarrhea (OR: 1.55, 90% CI: 1.02, 2.35). Results illustrate the importance of carefully examining the behavioral aspects of nutritional intake. Decreases in intake during diarrhea are due to anorexia and not withdrawal of food by mothers. In response to reductions in child appetite during illness, mothers are more likely to encourage children to eat, while they tend to become more passive feeders after the diarrhea has stopped. Program efforts should focus on messages to feed children more actively especially after diarrhea episodes, when appetite levels increase. (*Am J Public Health* 1991; 81:43–47)

## *Introduction*

Worldwide studies of infant and child nutrition have demonstrated that poor infant feeding and weaning practices along with frequent infections, in particular diarrheal diseases, are important determinants of growth faltering and malnutrition in the developing world.[1-3] However, the primary focus of diarrheal disease control (CDD) programs has been on improved case management through the promotion of oral rehydration therapy, while dietary management has been relatively neglected. Where program messages do exist, they are generally quite vague—such as "continue feeding during diarrhea"—and therefore may be difficult for mothers and other caretakers to implement.[4]

The development of specific recommendations for feeding practices requires information about existing infant feeding practices during illness. In the absence of data, the public health community has often assumed that mothers in nearly all cultures withhold food from their children during diarrhea episodes.[5-8] This implies that modification of this ill-advised presumed behavior will reduce the negative nutritional effects of diarrhea. Such a perspective ignores the possibility that mothers may already be feeding their children during diarrhea, and that diarrhea-associated anorexia may be the major determinant of reduced dietary intakes.[9-10]

This study focused on the behavioral factors related to feeding during diarrhea, and assessed the relationship of illness to appetite in young children. In particular, we quantified the degree of effort caretakers applied to encourage children to eat and the acceptance of food by children during diarrhea episodes, the immediate postconvalescent period, and subsequent, symptom-free days of "health."

## *Methods*

### *Data Collection*

The study was conducted in a rural Andean village in the Callejon de Huaylas, Peru as part of the Dietary Management of Diarrhea program, funded by the United States Agency for International Development, Office of Nutrition. It was implemented in Peru by the Institute of Nutrition Research and the Federal and State Ministries of Health in collaboration with Johns Hopkins University. The project has been described in greater detail elsewhere.[11-12]

Morbidity surveillance in the study area identified children with diarrhea by visiting each household at 48-hour intervals. A total of 118 children, between the ages of 4–36 months, were under surveillance for 12 months. Diarrhea was defined as four or more liquid or semi-liquid stools/day, convalescence as 0–1 liquid or semi-liquid stools/day immediately after at least two days of diarrhea, and healthy observation days as an absence of any illness symptoms. This latter requirement was quite problematic, since children in this setting were frequently ill with some sort of infection.

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**TABLE 1—Mean Energy (Kcal/kg/day) and Protein (g/kg/day) Intake by Stage of Illness among Breastfed Children 4–36 Months of Age**

| Intake | Stage of Illness | | |
|---|---|---|---|
| | Diarrhea | Convalescence | Symptom-Free |
| | n = 36 | n = 36 | n = 36 |
| Kcal/kg/day | 76* | 85 | 86* |
| g/kg/day | 1.3† | 1.5 | 1.6 |

*Difference = 10 kcal/kg/day (p = 0.052)
†Difference = 0.3 g prot/kg/day (p = 0.009)
SOURCE: Esrey *et al*, FASEB 1988

Twelve-hour in-home structured observations of maternal and child feeding behavior were completed, during two to four days each of diarrhea, convalescence, and health. Forty children (drawn from the population under surveillance) were studied for the present study. Children were eligible for this study if, on the day of morbidity surveillance they met the criteria for diarrhea, if the episode was no more than one or two days old, if the children were not exclusively breastfed, and if a data collector was available to begin a set of 12-hour observations. Children were selected for across a full calendar year.

Weighed dietary intakes of the same children, reported in detail elsewhere,[13] demonstrate that there is a decrease in dietary intakes during diarrhea (Table 1). What remains to be explained is why these reductions occur.

A data sheet was developed to code observations of maternal feeding behaviors and child acceptance of food during each meal. A total of 787 meals were recorded for the 40 children. For 75 percent of the meals, mothers were the feeders, so we refer to "maternal feeding behavior" in our discussion. Neither the identity of the caretaker nor that of the observer was found to be significantly associated with either the mother's or child's behavior (data available from authors on request).

Behavioral observations were made at the level of the food or drink, for a total of 951 observations. Feeding observations of commercial oral rehydration solution (ORS) and non-caloric teas have been excluded. If a child consumed potatoes and soup during the same meal, the data collector would code child acceptance of food behaviors separately for each food. This was done because field testing showed that behaviors varied within a single meal episode, depending on the food offered. In addition, we wanted to assess whether children preferred or rejected specific types of food, either during illness, recovery, or health.

Data collectors were aware only that the purpose of the research was to measure diet and feeding behavior during illness, along with other household treatment behaviors. To check whether the invasive nature of the study methodology (that placed data collectors in homes for repeated 12-hour observations) may have influenced maternal feeding behavior, a series of three-hour feeding observations without weighing either food or children before and after breastfeeding were completed for 30 children. There were no significant differences in the frequency or duration of breastfeeding between the three-hour and 12-hour observations (data available from author on request).

### *Scale Construction*

The data sheet contained five items measuring maternal feeding behavior and four items measuring child acceptance of food. Because these items had a logical order (i.e. mothers would not physically force children to eat if they had not already encouraged and pressured them verbally to eat), Guttman scaling techniques were used for scale construction.[14–15] The coefficients of reproducibility were quite high, .98 for Maternal Encouragement to Eat and .97 for Child Acceptance of Food, indicating that the observed response patterns fit closely the response patterns predicted by the Guttman analysis. After testing, three items remained in each scale.

For the Maternal Feeding Behavior scale the final items were: 'Verbally Encourage'→ 'Verbally Pressure'→ 'Physically force.' For the Child Acceptance of Food scale the items were: 'Rejects Food'→ 'Appetite Level'→ 'Asks for Food.' These two scales were then used as the dependent variables in the statistical analyses.

The Child Acceptance of Food scale was validated against actual intakes by comparing the mean scale for the day to the number of kilocalories from non-breastmilk for the day. Because the scale is ordinal rather than interval, Spearman's rho formula was used to calculate the correlation. The final Spearman correlation coefficient was .47, which shows a strong relationship between the scale and actual intakes.

There is no obvious means of validating the Maternal Encouragement to Eat scale against actual intakes. Increased encouragement to eat is a response to decreased appetite. The lower the appetite, the more encouragement children receive. Since maternal encouragement may or may not be successful, it is not clear that actual intakes should be associated with encouragement.

### *Cumulative Logistic Regression*

To preserve the ordered categorical nature of the scales, cumulative logit procedures were used[16] and separate logistic regressions were performed for each cut-point (i.e. each ascending value on the scale). Because our early models indicated that the magnitude and direction of the beta estimates for various factors were not consistent across these cut-points, we were not able to make an assumption of "proportional odds," which would have allowed us to report only one set of final beta estimates. For the Maternal Feeding Behavior scale, only two cut-points were used because just 13 observations scored 3, which was too small a percentage of observations to compare with the 0–2 category.

The main hypothesis was that "stage of illness" affects both maternal and child feeding behavior, so this variable was entered into the model first. Then, because we knew that age should theoretically influence feeding behavior, we added age to the model as a categorical variable. The study design followed children prospectively through diarrhea, convalescence, and health, as they were aging. Children 4–5 months old were omitted from these analyses because they were few in number and inconsistent in preliminary analyses. Even with age in the model, "stage of illness" was significantly associated with feeding behavior and child acceptance of food.

Two different techniques were used to test for possible confounding factors, one following Kleinbaum, *et al*,[17] and one following Greenland.[18] Both were modified to allow the examination of polychotomous dependent and independent variables. On the Maternal Feeding Behavior

**TABLE 2—Final Logistic Regression Model, Mother's Encouragement to Eat Score (1st Maternal Feeding Behavior Scale Cut-Point: 0 vs 1–3)**

| | Odds Ratio | 90% Confidence Interval |
|---|---|---|
| Intercept | 0.66 | (0.36, 1.24) |
| Stage of illness | | |
| Ref: Diarrhea | 1.00 | — |
| Convalescence | 0.54 | (0.35, 0.82) |
| Health | 0.65 | (0.46, 0.93) |
| Age (months) | | |
| 6–11 | 0.82 | (0.35, 1.93) |
| 12–17 | 1.65 | (0.70, 3.88) |
| Ref: 18–36 | 1.00 | — |
| Consistency | | |
| Ref: Liquids/semi-solids | 1.00 | — |
| Solids | 0.39 | (0.30, 0.51) |
| Breast milk consumed (kcal) during 12-hour observation | | |
| Ref: None | 1.00 | — |
| ≤410 | 1.82 | (0.87, 3.80) |
| >410 | 1.63 | (0.69. 3.84) |

**TABLE 3—Final Logistic Regression Model, Child's Acceptance of Food Score (2nd Child Food Acceptance Scale Cut-Point: 0,1 vs 2,3)**

| | Odds Ratio | 90% Confidence Interval |
|---|---|---|
| Intercept | 1.50 | (0.81, 2.76) |
| Stage of illness | | |
| Ref: Diarrhea | 1.00 | — |
| Convalescence | 1.12 | (0.77, 1.64) |
| Health | 1.55 | (1.02, 2.35) |
| Age (months) | | |
| 6–11 | 1.49 | (0.92, 2.40) |
| 12–17 | 0.90 | (0.55, 1.48) |
| Ref: 18–36 | 1.00 | — |
| Breast milk consumed (kcal) during 12-hour observation | | |
| Ref: None | 1.00 | — |
| ≤410 | 0.48 | (0.31, 0.74) |
| >410 | 0.28 | (0.15, 0.49) |
| Consistency | | |
| Ref: Liquids/semi-solids | 1.00 | — |
| Solids | 0.62 | (0.47, 0.82) |
| Kilocalories consumed at the last feeding, either breastmilk or solid food | | |
| Ref: 0–33.4 | 1.00 | |
| 33.4< <64 | 0.58 | (0.43, 0.77) |
| ≥64 | 3.32 | (2.42, 4.56) |

scale, variables were retained in the model if they were found to be confounders at either cut-point, while on the Child Acceptance of Food scale, variables were retained if they were found to be confounders at two of the three cut-points. Variables tested include, among others, type and consistency of food, caloric density of the food, kilocalories eaten at last meal, time since last meal, amount of breastmilk consumed during the observation period, the number of breastfeeding episodes, time of day, number of meals during the day, sex of child, identity of caretaker, and number of foods at a meal.

The variable fever (measured with a fever strip and later dichotomized) was deleted from the final analyses because, although highly significant in the preliminary analysis, the number of observations when fever was present (n = 17) was too small for multivariate analyses. However, a simple odds ratio of fever with appetite scores at cut-point 2 (corrected for intra-child correlation) shows that fever is much more likely to be associated with lower appetite (odds ratio = 0.06, 90% confidence interval: 0.01 to 0.46).

The final models were developed by adding to the model of stage of illness and age those variables that proved to be confounders. In addition, food consistency was added to both models since it was found to be closely related to both child appetite and maternal encouragement. Final variance estimates were corrected for the presence of intra-child correlation due to the longitudinal nature of the study design.[19]

## *Results*

In the interest of brevity, the final models presented are those with cut-points closest to the median for both scales (Tables 2 and 3). However, when results for other cut-points differ significantly for the variables of primary interest, these are discussed.

For the Maternal Feeding Behavior scale (Table 2), when controlling for age and the other factors shown, the scores were significantly lower during convalescence and health compared to diarrhea (for the second cut-point, i.e., 0–1 vs 2–3, scores were not significantly lower for convalescence). In other words, mothers were more likely to encourage their children to eat during diarrhea episodes, compared to the other two intervals. In addition, mothers gave more encouragement when their children were eating liquid or semi-solid foods.

For the Child Acceptance of Food model (Table 3), when controlling for age and the other factors shown, children had lower food acceptance scores during diarrhea compared to health. For this cut-point, food acceptance scores were not significantly higher during convalescence, compared to diarrhea, but they were significantly higher in the model for the third cut-point (i.e., 02 vs 3).

Acceptance of food scores were higher when children were presented liquid or semi-liquid foods, compared to solids, regardless of stage of health. Twelve-hour breast milk intake was negatively associated with appetite on the child scale, indicating that higher levels of breast milk intake reduced appetite for non-breast milk foods. Breast milk consumption was measured by weighing the children immediately before and after breastfeeding.

Interestingly, in the preliminary screening, Kcals from breast milk consumed between meals was not signifi-

**TABLE 4—Cross-Tabulation of Maternal Encouragement to Eat Scale and Child Acceptance of Food Scale**

| Maternal Scale (Low to High) | Count Row% Col% | Child Scale (Low to High) 0 | 1 | 2 | 3 | |
|---|---|---|---|---|---|---|
| | 0 | 12 | 191 | 254 | 79 | 536 |
| | | 2.2 | 35.6 | 47.4 | 14.7 | |
| | | 27.9 | 63.5 | 67.6 | 70.5 | |
| | 1 | 13 | 91 | 112 | 31 | 247 |
| | | 5.3 | 36.8 | 45.3 | 12.6 | |
| | | 30.2 | 30.2 | 29.8 | 27.7 | |
| | 2 | 18 | 19 | 10 | 2 | 49 |
| | | 36.7 | 38.8 | 20.4 | 4.1 | |
| | | 41.9 | 6.3 | 2.7 | 1.8 | |
| | | 43 | 301 | 376 | 112 | 832 |

Goodman and Kruskal's Gamma = −.23851

cantly associated with the child's food acceptance at the subsequent meal, although the coefficients for this factor were negative, as was the case for 12-hour breast milk intake. We interpret this to mean that breastfeeding is associated with an overall reduction of child appetite for other foods, which cannot be adequately assessed at a meal level. This relationship did not appear to be confounded by time, as time since last breastfeeding was not found to be significantly associated with child's food acceptance.

Another function included in the screening, namely Kcal from either breast milk or non-breast milk consumed during the last feeding episode, was positively associated with child appetite at the current meal when comparing a high level of consumption (≥64 Kcal) to a low level (≤33.4 Kcal). However, the relationship was negatively associated when comparing an intermediate level (between 33.4 and 64 Kcal) to a low level. This same inconsistency was observed for the first cut-point, but for the third cut-point, both the intermediate and high levels were positively associated with child appetite. Because the positive association is consistent with the preliminary analyses, we expect that this is the correct direction.

A cross-tabulation of the scores on the Maternal Encouragement to Eat Scale and those on the Child Acceptance of Food Scale (Table 4) shows a clear negative relationship between the two scales, suggesting that mothers were increasing their efforts to feed their child as the child's appetite decreased. This relationship would have appeared stronger if the effect of food type was removed from both scales because the logistic analysis showed that both child acceptance and maternal encouragement increased when liquid and semi-solid foods were involved. The table also shows that these mothers were generally passive feeders, 64 percent of the time giving no encouragement to eat. These data corroborate the same finding in our early ethnographic work on this population. However, at the lowest level of child acceptance of food, over 70 percent of the time, mothers gave some encouragement.

## *Discussion*

The results from this study demonstrate that these Peruvian mothers, normally quite passive child feeders, were more likely to encourage their children to eat during diarrhea episodes compared to both convalescence and health. Children experiencing diarrhea did appear to have observable reductions in appetite, and more often rejected food. These results corroborate our ethnographic data. Mothers frequently voiced concern that their children were "weak" and had reduced appetites during diarrhea.[11]

The more total kilocalories consumed by the child during the previous meal or breastfeeding, the better the appetite at the current meal. At first, this seemed counter-intuitive, but Esrey, *et al*,[13] found that these children averaged only 71 percent to 91 percent of recommended energy intakes, so if the children were not suffering from diarrhea or fever-induced anorexia, they would probably be willing to eat whenever food was offered. If this was the case, a child's appetite at any given meal would reflect the general level of health for the day rather than the amount consumed at the previous meal/breastfeeding, which was borne out by the positive relationship between appetite at the current meal and kilocalories consumed at the previous meal/breastfeeding. Again, this relationship did not seem to be confounded by time since last meal/breastfeeding, which was tested and was not significant.

What is the public health significance of these data? First, it is clear that in this setting mothers are not withholding food from their children when they experience diarrhea. Where this issue has been closely studied in other sites, similar results have been found. For example, in Nigeria, where we have used the same methodology as in this Peruvian site, mothers appear to force-feed their children more often when they have diarrhea, possibly as a response to their children's refusal to eat.[20] In India, some mothers shift the diet during diarrhea toward foods that they perceive as "helpful" and away from foods perceived as "harmful."[21] In each of these three sites, mothers' concern about appetite loss during diarrhea was high.[11,20–22] We hope that these data will replace the anecdotal information and survey data that reports that mothers "starve" their children during diarrhea episodes.

The role of anorexia during diarrhea appears to be an important factor in reductions of dietary intake during illness. We are not aware of other studies that have attempted to measure the degree of appetite of children in a field setting, although one clinic-based study suggested that anorexia was an important mechanism for reduced dietary intake during diarrhea.[23] Although it is expected that children's appetites should rise during the convalescent phase, in the present study this was observed only when logistic regressions were done that split children with high appetites into a separate group. In this case, child acceptance of food did rise during convalescence, suggesting that program messages should communicate to mothers the need to feed their children more during the recovery period. The data here show that mothers discontinued their more active encouragement to eat when diarrhea stopped, thereby missing an opportunity for their children to consume important "catch-up" nutrients. Program messages, therefore, should focus on a child's increase in appetite during the convalescent period, and encourage mothers to actively feed their children both during *and* after diarrhea. In addition, specific recommendations on foods appropriate

during diarrhea and convalescence could be made and less emphasis placed on vague feeding messages. These messages should be based on cultural beliefs regarding appropriate foods to offer during diarrhea.[12]

We have shown a clear link between the presence of fever and the rejection of food by children. The effect of fever on appetite is worrisome because of the number of infections where fever is commonly present, such as upper respiratory infections and malaria. Lopez de Romaña, *et al*,[24] found fever present in children during 13.7 percent of all illness days, and Brown, *et al*,[25] reported an approximate 30 percent reduction in dietary intake among weanlings whose mothers reported the presence of fever, although Martorell, *et al*,[26] found no link between fever and growth rates. Clearly, more work is required to investigate the effect of fever on dietary intake and growth, and whether the administration of acetaminophen improves the acceptance of food by ill children (Gove, personal communication).

In conclusion, this study illustrates the importance of examining the behavioral aspects of nutritional intake. Simply measuring changes in caloric intake does not provide an explanation as to why the changes have occurred, so interventions may be based on faulty assumptions of behavior. In this case, mothers do not, as commonly assumed, withhold food from children with diarrhea. On the contrary, they actually increase their efforts to feed their children, as a response to the child's decreased acceptance of food. □

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