

Assessment of nutritional status, cognitive development, and mother-child interaction in Central American refugee children

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ABSTRACT

A cross-sectional study was conducted between July and December 1992 to assess the nutritional status, cognitive development, and mother-child interactions in a group of 153 Nicaraguan refugee children living in Costa Rica. Nutritional status was assessed using anthropometric indices. Cognitive development was assessed with the Bayley Scale of Mental Development. Mother-child interaction was assessed with the Nursing Child Assessment Teaching Scale and Caldwell's Home Observation and Measurement of the Environment Inventory.

Correlational analysis was performed to examine the relationship between child cognitive development scores and mother-child interaction measures and also between anthropometric measures and child cognitive development scores. Multiple regression analysis was performed to evaluate the relationship between the mother-child interaction measures and cognitive development scores, after adjusting by anthropometric measures.

Thirty-three percent of the children were below the 10th percentile for height-for-age. There was no significant correlation between the total amount of mother-child interaction and child cognitive development. However, certain aspects of the home environment correlated with cognitive development, specifically the manner in which the mother responded emotionally and verbally to her child, and the organization of the child's physical and temporal environment. Multiple regression analysis revealed that the manner in which the mother responded and the child's weight-for-height were important in predicting child cognitive development.

The child's weight-for-height and certain aspects of the home environment played an important role in the cognitive development of this refugee population. The findings indicate the importance of assessing nutritional status in this refugee population.

Children under 4 years of age have represented a large portion of the Nicaraguan refugee population in Costa Rica.² At the time of this study,

in 1992, many of the families of these children had been in Costa Rica for several years. Meeting the needs of these refugee children has been and will likely continue to be a challenge for public schools and for agencies offering resettlement services. The refugee presence has made the development of adequate nutritional services for refugees a major concern for the Costa Rican Ministry of Health and the country's health care system. Refugee children have special needs because of their vulnerability to malnutrition and

other experiences that can directly affect their growth and development (1). In a study of the nutritional status of Guatemalan refugee children in Mexico, Flores-Huerta et al. (2) found that 19% of the children had severe retardation of height-for-age, indicative of a chronic lack of energy foods. Eighty-four percent had low weight-for-age. Thirty-nine percent had low weight-for-height, indicating acute malnutrition. Refugee children may also be at risk for cognitive dysfunction as a result of an environment characterized

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² Flores M. Health status in Costa Rica. Presentation at Faculty Seminar Series, University of South Florida College of Public Health and Costa Rican Ministry of Health, Tampa, Florida, 1989.

by limited variation in sources of stimulation and inadequate mediated learning experiences (3).

High-quality interactions during the first year of life have been positively associated with the child's subsequent cognitive and linguistic competence, and to more secure attachments to major caregivers (4, 5). The most consistent correlates of child cognitive development have been specific behaviors of the mother relating to maternal responsiveness; however, the research has not been able to establish a general model that identifies the particular characteristics of mother-child interaction or the particular aspects in the mother-child relationship that are predictive of cognitive performance. The relationship between mother-child interaction and cognitive development also needs further examination in different populations and at various ages.

The relationship between malnutrition and cognitive development has been examined by several researchers (6, 7). In a prospective study of 219 Ohio children, Ernhart et al. (6) found a significant correlation between 6-month weight and 1-year cognitive development, using the Bayley Scale of Mental Development. Grantham-McGregor et al. (7) found that the developmental quotient of a group of malnourished children who did not participate in a stimulation program remained low three years after hospitalization. On the other hand, a stimulated malnourished group caught up to a control group of adequately nourished children in spite of the former group's continuing poor nutritional status (7).

Little has been published on the nutritional status, cognitive development, and mother-child interaction patterns of refugee populations. The purpose of this study was to assess those characteristics for a sample of Nicaraguan refugee children in Costa Rica. The information from this study will be useful in defining nutritional initiatives for refugee children. In addition, assessing these children's environment and their developmental level may provide researchers with information that will help in designing appropriate

intervention programs to meet these children's long-term growth and development needs.

MATERIALS AND METHODS

The present study employed a cross-sectional study design to assess, at the same point in time, the nutritional status, cognitive development, and mother-child interaction patterns in a sample of Nicaraguan refugee children in Costa Rica. A comparison group of economically comparable Costa Rican children who were not refugees was selected to provide comparative cognitive development scores. Demographic information was obtained from both groups to test for any confounding effects on cognitive development due to differing distributions of demographic characteristics. The study sought to answer the following research questions: (a) What was the refugee children's nutritional status?, (b) Was there a correlation between the amount and type of mother-child interaction behaviors and child cognitive development scores?, and (c) Was there a correlation between the amount and type of mother-child interaction behaviors and child cognitive development after taking into account the effect of nutritional status?

Instrumentation

Nutritional status. Nutritional status of the refugee children was assessed from anthropometric measurements. Height-for-age, weight-for-height, and weight-for-age were calculated after obtaining each child's sex, age, weight, and height during a home visit. The procedures followed to measure child height and weight were ones developed by the United Nations National Household Survey Capability Programme (8).

Mother-child interaction. Mother-child interaction patterns in the refugee families were assessed using two child health evaluation instruments, the Nursing Child Assessment Teaching Scale (NCATS) and the Home Ob-

servations and Measurement of the Environment (HOME) Inventory.

The NCATS consists of 73 "yes" or "no" items that describe mother-child interaction during a period of teaching by the mother. Observing a mother's teaching interactions with her child provides useful information on important features of the mother-child relationship, the mother's teaching style, and the association between teaching style and the child's performance and ability on specific tasks. The NCATS has six subscales, two of which describe the child's behaviors and four of which describe the mother's behaviors.

The NCATS child subscales summarize: (a) the clarity of the child's cues that he or she sends to the mother and (b) the child's responsiveness to the mother. A child may send many types of cues, such as sleepiness, alertness, hunger, and changes in body activity. The clarity with which a child sends these cues can facilitate or hinder the mother's ability to identify the cues and to make appropriate changes in her behavior. Similarly, the child must be responsive to the behavioral cues of his or her mother to permit changes in his or her behavior.

The NCATS subscales for the mother's behavior summarize: (a) the mother's sensitivity to the child's cues, (b) the mother's response to the child's distress, (c) activities to foster the child's social-emotional development, and (d) activities to promote the child's cognitive development.

Internal consistency reliability estimates (Cronbach's alpha) ranging from .79 to .85 for the NCATS total teaching score have been obtained from data collected by Nursing Child Assessment Satellite Training trainees (9); there is moderate consistency across the teaching scale for most of the subscales.

The HOME Inventory uses interviews and observation to assess the social, emotional, and cognitive support available to the child in the home setting (10). The HOME scale consists of 45 "yes" or "no" items divided into six subscales: (a) verbal and emotional responsiveness of mother, (b) avoidance of restriction and punishment, (c) organi-

zation of the child's physical and temporal environment, (d) maternal involvement with the child, (e) provision of appropriate play materials, and (f) opportunities for variety in daily stimulation. The HOME subscales measure the quality of parenting in terms of both mother-child interaction behaviors and the characteristics of the physical environment provided for the child. The HOME instrument has been used extensively in research studies for 20 years and has satisfactory internal reliability. However, several of the HOME Inventory subscales have only modest interitem reliability, with alpha coefficients ranging from .44 to .89 for each subscale (10).

Child development. Information regarding the developmental status of the refugee children was obtained using the Bayley Scale of Mental Development, a widely used instrument with documented reliability and validity (11).

Comparative Bayley scores were obtained by administering the instrument to a group of 48 economically comparable Costa Rican children. The group was selected primarily from children being seen at a large public pediatric clinic in San José that serves about 150 000 patients per year. The average monthly family income of patients seen at this clinic was 20 000 Costa Rican colones (about \$US148, using the rate of exchange at the time of the study).

During regularly scheduled well-baby visits, Costa Rican mothers with children meeting the age and health criteria were asked if they would be willing to have their child evaluated by the investigator. All the mothers agreed, and the investigator scheduled appointments with the women for the following week. A few mothers didn't appear for their appointments, and two evaluations had to be thrown out because of incompleteness due to the mothers' arriving late, at the time of the next scheduled appointment.

Eligibility criteria for the Costa Rican comparison group were age of the child between 2 and 30 months at the

time of the study and normal, term-birth status. Eligibility criteria for the refugee group included: (a) presence of a child in the family between 2 and 30 months of age, (b) refugee status of the mother, (c) Nicaraguan nationality of the mother, and (d) residence in the study population area. Excluded were: (a) chronically ill and severely handicapped children, (b) children weighing less than 1500 g at birth, (c) children born more than 1 month premature, and (d) infants with any evidence of intrauterine growth retardation.

Data collection and procedures

After reviewing the records of agencies serving refugees, four sites with children in the criteria ages were selected. The four locations were: (a) the International Rescue Committee (IRC) active service population in the San José metropolitan area, or IRC Urban Program (109 mothers interviewed), (b) the IRC active service population in the rural area of the neighboring province of Alajuela, or IRC Rural Program (9 mothers interviewed), (c) a community of makeshift houses in Finca San Juan, west of the capital in the province of San José (32 mothers interviewed), and (d) a day-care center located in Desamparados, also in the province of San José (3 mothers interviewed). Data were collected during a 4-month period between July and November 1992. For families with more than 1 child in the eligible age range, the child assessed was selected randomly by flipping a coin. Nineteen families had 2 children meeting the age criteria; no family had more than 2 children in the eligible age range.

The informed-consent form approved by the University of South Florida Health Sciences Center Institutional Review Board for the Protection of Human Subjects was read to each mother.

Data processing

Bayley raw scores were converted to equivalent Mental Development Index

(MDI) scores using values from the tables in the Bayley manual (11). Anthropometric data were entered using the anthropometric calculation program of Epi Info Version 5 (12).

Data analysis

The means and standard deviations for the MDI scores from the Costa Rican sample and from the refugee sample were compared using *t* tests. Cumulative frequency distributions of MDI values were prepared for the Costa Rican and refugee groups, and *t* tests using 95% confidence intervals were used to test the hypothesis that the mean MDI scores were 100. Analysis of covariance was performed to test the difference in mean standard scores, after adjusting by such selected demographic variables as family income and mother's years of education.

For the refugee sample, means and standard deviations were calculated for total and subscale scores on the NCATS teaching scale and on the HOME Inventory. The height-for-age, weight-for-age, and weight-for-height indices were expressed in terms of *Z* scores obtained using the Epi Info Version 5 program (12). The calculations performed with this program are based on growth reference curves developed by the U.S. National Center for Health Statistics (NCHS) and the U.S. Centers for Disease Control (CDC) using data from the Fels Research Institute and U.S. Health Examination Surveys (13). The *Z* score for the reference population has a normal distribution, with a mean of 0 and a standard deviation of 1.

Correlational analysis was performed to examine the relationship between the mother-child interaction behavior measures and the child cognitive development scores, as well as the relationship between the anthropometric *Z* scores and the child cognitive development scores. Partial correlation coefficients were calculated to examine the relationship between the mother-child interaction behavior measures and cognitive development, after adjusting by the anthropometric

Z scores. Multiple regression analysis was performed to evaluate the relationship between the mother-child interaction measures and cognitive development scores, after adjusting by anthropometric Z scores.

Sample size determination

It was determined that a sample size of 151 was needed to detect a statistically significant difference in the proportion of the refugee population with low cognitive development scores (i.e., < 1 SD from the mean), within a 4% margin of error at a 95% confidence level (14).

RESULTS

Comparison of Costa Rican and refugee samples

Table 1 shows the mean Bayley Mental Development Index scores for the Costa Rican children and for the refugee children. There was no significant difference in mean MDI values for the two groups. The average Bayley MDI for refugees was not significantly different from 100 ($t(152) = 1.4$, $P = 0.16$), the standardized mean for the United States of America. However, the Costa Rican mean MDI differed significantly from 100 ($t(47) = 2.13$, $P = 0.04$). The variances around the means were homogeneous in both the Costa Rican and refugee groups.

Information on birthweight, birth length, birth head circumference, and the Apgar scores for physical health at the time of birth were obtained using actual figures given in the child's health record (*carnet*). The mothers were interviewed directly to obtain the other health and demographic information, on birth order, child age, mother's age at child's birth, mother's education, and parity. Boys comprised 54% of both the Costa Rican sample and the refugee sample. Table 2 shows the demographic characteristics of the Costa Rican and refugee mothers and children. Refugee children had a higher mean birth order than Costa Rican chil-

TABLE 1. Mean Bayley Mental Development Index scores for Costa Rican ($n = 48$) and refugee children ($n = 153$), Costa Rica, 1992

Children	Mean MDI ^a	SD	CI	<i>t</i>	df
Costa Rican	105.08	16.50	(100.28, 109.88)	1.2 ^b	199
Refugee	101.84	16.24	(99.24, 104.44)		

^a MDI = Bayley Mental Development Index.

^b $P = 0.23$.

TABLE 2. Selected background characteristics of Costa Rican and refugee mothers and their children, Costa Rica, 1992

Characteristic	Costa Rican children			Refugee children			<i>t</i>	<i>P</i>
	Mean	SD	<i>n</i>	Mean	SD	<i>n</i>		
Birthweight (kg)	3.13	0.58	48	3.12	0.49	150	0.12	.90
Birth length (cm)	49.08	2.53	13	49.18	2.44	97	0.14	.89
Birth head circumference (cm)	33.29	2.56	7	33.59	1.43	63	0.31 ^a	.77
1-min Apgar	8.33	0.65	12	8.45	1.19	86	0.53 ^a	.60
5-min Apgar	9.08	0.52	12	9.00	1.26	86	0.41 ^a	.68
Birth order	2.09	1.37	47	2.77	1.85	152	2.75 ^a	<0.05
Child age (mo)	13.01	6.33	48	14.43	7.85	153	1.15	.25
Mother's age								
at birth of child (yrs)	27.15	5.97	47	25.64	5.93	149	1.51	.13
Mother's education (yrs)	8.55	3.27	42	6.50	3.79	150	3.19	<0.01
Parity	2.02	1.01	43	2.90	1.87	153	4.04 ^a	<0.001

^a *t* statistic using Satterthwaite's approximation (15).

dren, with a range from one to nine. Thirty percent (45/152) of the refugee children were firstborn; however, 27% (41/152) were the fourth child or later. In the Costa Rican sample, 43% (20/47) were firstborn and 28% (13/47) were secondborn. Refugee mothers had completed a lower mean number of years of education, ranging from 0 to 17 years, and also had a higher parity.

Table 3 shows the results after adjusting the Costa Rican and refugee mean MDI scores by the demographic variables. There was no difference in mean MDI values after adjustment by any of the background variables. Tests for interaction between the background variables and the variable representing group (i.e., Costa Rican or refugee) were not significant, with the exception of the test for parity-group interaction. The test for interaction between parity and group was significant ($F(1, 192) = 4.91$, $P < 0.05$). After adjusting the group means by the interaction

between parity and group, there was a significant difference in the Costa Rican and refugee mean MDI scores.

Description of refugee sample

Of the 153 refugee mothers, 95 of them (62%) were homemakers; 34 (22%) were unskilled workers (e.g., domestic workers); 12 (8%) were self-employed (e.g., merchants, artisans, or seamstresses); and 7 (5%) were skilled workers (e.g., receptionists or machinists). Thirty-nine (26%) of the refugee partners/fathers were self-employed (e.g., merchants, artisans, or small business owners); 33 (22%) were unskilled workers (construction workers, salesmen, laborers, or cooks). Mothers could not provide any information on 18 (12%) of the men. The average monthly income of the employed refugee families was 22205 colones, the equivalent of about \$US164 at the time

TABLE 3. Comparison of Costa Rican and refugee children, mean Bayley scores after adjustment by selected background characteristics, Costa Rica, 1992

Costa Rican children			Refugee children			F	P	Adjusting characteristic
Adjusted mean MDI ^a	SE	n	Adjusted mean MDI	SE	n			
105.04	2.33	48	101.82	1.32	150	1.44	.23	Birthweight (kg)
100.93	4.35	13	102.90	1.59	97	0.18	.67	Birth length (cm)
102.90	5.69	7	103.95	1.89	63	0.03	.86	Birth head circumference (cm)
100.76	4.58	12	101.82	1.71	86	0.05	.83	1-min Apgar
100.48	4.58	12	101.86	1.71	86	0.08	.78	5-min Apgar
103.92	2.37	47	102.00	1.31	152	0.50	.48	Birth order
103.88	2.03	48	102.21	1.14	153	0.51	.48	Child age (mo)
105.08	2.36	48	101.84	1.32	153	1.44	.23	Child sex
105.79	2.37	47	101.68	1.33	149	2.27	.13	Mother's age (yrs) at birth of child
105.46	2.52	42	102.34	1.31	150	1.19	.28	Mother's education (yrs)
108.62 ^b	2.90	43	102.31 ^b	1.28	153	3.98 ^b	<0.05 ^b	Parity

^aMDI = Bayley Mental Development Index.

^bResults are adjusted by group-parity interaction.

of the study. Of the refugee children, 142 (93%) were born in a hospital and 5 (3%) were born at home; that information was unknown for 6 other children, including 1 child born in Nicaragua.

Findings

Table 4 lists the means and standard deviations of the independent variables examined in the refugee sample. The mean height-for-age Z score for the entire refugee sample ($n = 153$) was -0.81 (95% CI: -0.98 to -0.64) and differed significantly from 0, the mean of the NCHS/CDC reference population ($t(152) = 9.63$, $P < 0.0001$). The prevalence of low height-for-age was higher in the refugee sample than in the reference population (Yates corrected $\chi^2(1, n = 153) = 62.71$; $P < 0.0001$). There was an elevated odds ratio for the association of refugee status with low height-for-age (OR = 6.02, Cornfield 95% CI: 3.58 to 10.04).

The mean weight-for-height z score for the entire refugee sample was 0.15 (95% CI: -0.04 to 0.34) and was not statistically different from 0 ($t(152) = 1.59$, $P = 0.11$). The prevalence of low weight-for-height in the refugee sample was not significantly greater than in the reference population (Yates corrected $\chi^2(1, n = 153) = 0.27$; Fisher exact

2-tailed $P = 0.41$). There was no association between refugee status and low weight-for-height (OR = 1.44, Cornfield 95% CI: 0.52 to 3.64).

The mean weight-for-age Z score for the entire refugee sample was -0.42 (95% CI: -0.59 to -0.25) and differed significantly from 0 ($t(152) = 4.95$, $P < 0.0001$). The refugee height-for-age and weight-for-height Z scores were normally distributed (Shapiro-Wilk = 0.09 and 0.28, respectively), but the refugee weight-for-age Z scores were not (Shapiro-Wilk = 0.004). The prevalence of low weight-for-age was significantly higher in the refugee sample than in the reference population (uncorrected $\chi^2(1, n = 153) = 11.96$; Fisher exact 2-tailed $P = 0.003$). The odds ratio for the association of refugee status with low weight-for-age was 2.97 (Cornfield 95% CI: 1.46 to 5.85).

Percentile distributions of height-for-age for the entire refugee sample indicated some extreme values for height-for-age at the 0.0–9.9th and 10.0–19.9th percentiles. Thirty-three percent of the refugees fell in the lowest percentile, compared to 10% of the reference population, and 20% fell in the next lowest percentile, compared to 10% of the reference population.

Comparison of the weight-for-height percentiles for the refugee sample and the reference population did

not show extreme values at the lowest percentile. However, 16% of the refugees fell in the highest (i.e., 90–100th percentile), and 12% fell in the 80–89.9th percentile.

Comparison of weight-for-age percentiles indicated that 25% of the refugee population fell in the lowest percentile, in contrast to 10% of the reference population.

There was no significant correlation between Bayley MDI cognitive development scores and the total amount of mother-child interaction as measured by the HOME Inventory score. However, there were positive correlations between the Bayley MDI and the first and third subscales of the HOME, for responsiveness of the mother ($r = 0.17$, $P < 0.05$) and for organization of the environment ($r = 0.17$, $P < 0.05$). There was no significant correlation between Bayley MDI and NCATS scores for total teaching, total parent teaching, or total child teaching. However, there was a positive correlation at the $P < 0.10$ level between the Bayley MDI and one NCATS parent subscale, for social and emotional growth fostering, and also with one NCATS child subscale, for clarity of cues.

Pearson correlation coefficients for the associations between the nutrition variables and Bayley MDI indicated that only weight-for-height ($r = 0.24$, $P < 0.01$) and weight-for-age ($r = 0.17$, $P < 0.05$) Z scores were correlated with Bayley MDI. Controlling for nutritional status, partial correlation coefficients for the HOME variables and Bayley MDI indicated little or no change in the precision of the correlation coefficient for the association between MDI and the HOME subscale for organization of the environment. However, after adjustment by nutritional status, the correlation coefficient for the association of MDI and responsiveness of the mother became more precise.

Based on the results of the correlation and partial correlation analyses and using stepwise regression procedures (16), 15 variables, including the 6 product terms, were entered into a regression model to predict Bayley MDI. Table 5 shows the results. Of the 15 variables entered, 5 variables were

TABLE 4. Means and standard deviations of the maternal-child interaction behavior and nutritional status variables, Nicaraguan refugee mothers and children, Costa Rica, 1992

Variable	Mean	SD	Range	n
Nutrition of children				
Height-for-age Z score	-0.81	1.04	-2.86 to 2.42	153
Weight-for-height Z score	0.15	1.17	-2.62 to 3.11	153
Weight-for-age Z score	-0.42	1.05	-2.39 to 1.94	153
Maternal-child interaction behaviors				
Caregiving environment				
Total HOME ^a score	26.01	3.43	18 to 38	153
Responsivity of the mother	7.07	1.28	5 to 11	153
Acceptance	6.06	0.65	5 to 8	153
Organization of the environment	4.63	1.00	2 to 6	153
Learning materials	2.24	1.65	0 to 7	153
Involvement	4.11	1.05	2 to 6	153
Variety	1.90	1.03	0 to 4	153
Teaching				
Total NCATS ^b score	46.26	5.22	33 to 58	153
Total parent teaching score	33.97	3.82	24 to 45	153
Sensitivity to cues	8.67	0.89	7 to 11	153
Response to distress	9.69	1.74	5 to 11	153
Social-emotional growth fostering	6.30	1.32	3 to 9	153
Cognitive growth fostering	9.31	2.11	4 to 15	153
Total child teaching score	12.28	3.16	5 to 21	153
Clarity of cues	7.35	1.07	5 to 10	153
Responsiveness to parent	4.93	2.40	0 to 12	153

^aHOME = Home Observation and Measurement of the Environment Inventory.

^bNCATS = Nursing Child Assessment Teaching Scale.

TABLE 5. Variables significant in the prediction of Bayley scores using stepwise regression procedures, Costa Rica, 1992

Variable	β	F ^a	P
Responsivity of the mother	7.84	43.42	<0.001
Responsivity of the mother \times child age	-0.33	29.55	<0.001
Cognitive growth fostering \times child age	0.11	8.56	<0.01
Weight-for-height Z score	1.90	4.41	<0.05
Organization of the environment	2.48	5.36	<0.05

^aF statistics for the full model are $F(5, 140) = 20.18$, $R^2 = .42$, $P < 0.001$.

significant at levels ranging from <0.001 to <0.05: (a) HOME responsivity of the mother, (b) an interaction term formed by this responsivity variable and child age, (c) HOME organization of the home environment, (d) weight-for-height Z score, and (e) an additional interaction term formed by NCATS cognitive growth fostering and child age.

Those five variables were then used to make the full predictive model. HOME responsivity of the mother significantly predicted Bayley MDI. An

interaction term formed by this variable and child age also significantly predicted MDI. HOME organization of the home environment was significant at slightly less than the 0.05 level. The weight-for-height Z score was an important predictor of MDI, both alone and when added to the other variables. An additional interaction term formed by the NCATS cognitive growth fostering and child age was significant alone and when added to the other variables. Analysis of the residuals for this model revealed no

pattern, suggesting the model is appropriate for the data obtained.

DISCUSSION

The assessment of the nutritional status of the refugee group as a whole reveals an excess number of refugee children in the lower percentile ranges of height-for-age, indicating stunting. Other work indicates that such slowing in skeletal growth may take many years to become evident (17). Stunting is frequently associated with inadequate nutrient intake and with poor overall economic conditions, especially infections that are mild to moderate, chronic, or repeated (18).

There does not appear to be a high prevalence of wasting in this sample; only 3% of the refugee group had weight-for-height Z scores less than -2. This might explain the positive association that this study found between weight-for-height Z score and cognitive development, and the lack of a relationship between height-for-age Z scores and cognitive development. Ernhart et al. (6) also found a relationship between nutritional status and cognitive development, specifically between the child's 6-month weight and 1-year Bayley MDI.

The refugee mothers had a relatively high score on the HOME subscale for responsivity of the mother (mean 7.07, SD 1.28). HOME studies in the United States reported a comparable score on this subscale, 7.6 (SD 2.4) at 6 months of age (19). The refugee mothers' high score may be a result of their general tendency to praise their children, one of the characteristics measured by this HOME subscale.

The refugee mothers' HOME score for organization of the environment was also relatively high (mean 4.63, SD 1.00); studies in the United States reported a mean of 4.62 (SD 1.14) at 6 months of age (19). The refugee mothers' high score may be a result of the consistent child care they provided, the number of trips they took with their children out of the home, and the regularity of physician/clinic visits, all aspects of the child's physical and

temporal environment assessed by this HOME subscale.

Both of these HOME subscales were positively associated with child cognitive development.

The significance of the interaction of child age with the HOME responsiveness of mother variable indicates the importance of child age in relation to cognitive development. The same level of mother responsiveness has a greater effect on children 6–12 months old than it does on children 18–24 months old.

The positive association between child age and the NCATS cognitive growth fostering variable indicates the importance of child age in assessing teaching behavior. Mothers generally were less verbal and were more restrictive in regards to task manipulation with younger children than with older children, two of the mother's behaviors assessed by the cognitive growth fostering subscale. On another of the activities measured by that subscale, mothers of a young child were also less likely to signal completion of the task directly to the child; they often told the investigator when the child had finished or looked in the investigator's direction. Mothers may have thought the child could not understand them and thus they did not think it was necessary to praise the child. This behavior with younger children may explain the positive association this study found between child age and cognitive growth fostering.

The regression analyses confirm the results of the correlation analyses in terms of the effects of mother-child interaction behaviors and of nutritional status on child cognitive development. Children who have responsive mothers, consistent care and organized environments, and adequate nutritional status tend to have high cognitive de-

velopment scores. Burchinal et al. (20) found that responsive mothers provided stimulating home environments. Beckwith, Rodning, and Cohen (5) found that children whose mothers were consistently more responsive during infancy later achieved higher IQ scores.

One of the limitations of this study was the inability to blind the investigator to refugee status, due to the nature of the data collection process. Since the major study site was an agency serving only refugee families, the refugee status of most of the mothers was known a priori. It is unclear how this awareness of the mother's refugee status influenced the results. Future studies are needed where the investigator is blinded to refugee status.

Because the data collected in this study were cross-sectional, there is a need for long-term studies to test the stability of the relationship that nutritional status and maternal-child interaction have with cognitive development in refugee children. Such studies will provide important information to help mothers maximize the future growth and intellectual performance of their children.

This study has several major implications. First, nutritional status appears to play an important role in determining a child's cognitive development. Second, there appear to be important areas of the environment that foster a child's development. These include providing an environment that responds to the child, a relatively high frequency of adult contact involving a relatively small number of adults giving consistent care, and a daily schedule that is orderly and predictable. Third, there appear to be important behaviors to foster cognitive growth that mothers use in teaching their children.

Among these are providing feedback, especially feedback contingent on the children's performance; giving praise and clear instructions; and using non-verbal as well as verbal instructions, in particular, pointing and showing. These behaviors exert different effects on child cognitive development at different ages. Lastly, the most consistent predictor of cognitive development in this group of refugee children seemed to be the type of environment the mother created through her verbal and emotional responsiveness to her child's qualities or behaviors.

Further research on the social environment and mother-child interaction patterns within refugee groups will establish bases for child development and growth that national-level officials can use in long-range planning for the needs of the refugee children.

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RESUMEN

Evaluación de estado nutricional, desarrollo cognoscitivo e interacción entre madre e hijo en niños refugiados centroamericanos

Entre julio y diciembre de 1992 se llevó a cabo un estudio transversal con el fin de evaluar el estado nutricional, el desarrollo cognoscitivo y la interacción entre madres e hijos en un grupo de 153 niños refugiados nicaragüenses que vivían en Costa Rica. Se evaluó el estado nutricional según índices antropométricos. El desarrollo cognoscitivo se determinó mediante la Escala de Desarrollo Mental de Bayley. La interacción entre madre e hijo se evaluó con dos instrumentos: la *Nursing Child Assessment Teaching Scale* [Escala Didáctica para la Evaluación de Lactantes] y el *Home Observation and Measurement of the Environment Inventory* [Inventario de Observación y Medición del Medio Ambiente] de Caldwell.

Se hizo un análisis de correlación para determinar la relación entre el puntaje en la escala del desarrollo cognoscitivo infantil y las mediciones de la interacción entre madre e hijo, así como entre las medidas antropométricas y los puntajes en la escala de desarrollo cognoscitivo infantil. Se aplicó un análisis de regresión múltiple para evaluar la relación entre las mediciones de la interacción y los puntajes en la escala de desarrollo cognoscitivo, después de controlar el efecto de las medidas antropométricas.

Se encontró que 33% de los niños tenían valores inferiores al décimo percentil en la relación entre talla y edad. No se observó ninguna correlación significativa entre la frecuencia total de la interacción entre madres e hijos y el desarrollo cognoscitivo del niño. No obstante, ciertos aspectos del ambiente domiciliario mostraron correlación con el desarrollo cognoscitivo, particularmente las características de la respuesta emocional y verbal de la madre hacia su hijo, y la organización del medio ambiente del niño en términos físicos y temporales. El análisis de regresión múltiple reveló que las características de la respuesta emocional de la madre y la relación entre el peso y la talla del niño eran factores de importancia para predecir el desarrollo cognoscitivo infantil.

La relación entre el peso y la talla del niño y ciertos aspectos del ambiente domiciliario desempeñaron un papel importante en el desarrollo cognoscitivo de esta población de refugiados. Estos resultados demuestran la importancia de evaluar el estado nutricional en esta población.