

ORIGINAL COMMUNICATION

Mothers of undernourished Jamaican children have poorer psychosocial functioning and this is associated with stimulation provided in the home

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Objectives: To compare mothers of undernourished children with mothers of adequately nourished children on maternal depression, parenting self-esteem, social support and exposure to stressors and to determine if these variables are independently related to undernutrition and stimulation provided in the home after controlling for socio-economic status.

Design: A case control study.

Setting: Children and their mothers were recruited from 18 government health centres in the Kingston, St Andrew and St Catherine parishes of Jamaica.

Subjects: One hundred and thirty-nine mothers of undernourished children ($WAZ \leq -1.5z$ scores) aged 9–30 months and 71 mothers of adequately nourished children ($WAZ > -1z$ scores) matched for sex and age group were enrolled into the study.

Results: Mothers of undernourished children came from poorer homes but had similar social support to mothers of adequately nourished children. They were more depressed, had lower levels of parenting self-esteem (both $P < 0.01$), reported higher levels of economic stress ($P < 0.001$) and provided a less stimulating home environment ($P < 0.05$). However, after controlling for social background variables there was no independent relationship between either psychosocial function or home stimulation and nutritional status. Undernutrition was found to be mainly explained by economic factors. The mothers' self-esteem was independently associated with the level of stimulation provided to the child.

Conclusions: When caring for undernourished children attention should be paid to the psychosocial status of the mother as well as the physical condition of the child.

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Introduction

Few studies have examined psychosocial characteristics of mothers of undernourished children in developing countries. In Barbados, mothers of 5–11-year-old children who

had been severely malnourished in the first year of life were more likely to be depressed than a control group but this difference was explained by the lower socio-economic status of the former group (Salt *et al*, 1988). We found no studies investigating the psychosocial function of mothers of currently undernourished children in developing countries. A few studies with failure to thrive children in developed countries have examined the psychosocial characteristics of mothers but the results have been inconclusive (Boddy & Skuse, 1994).

Maternal psychosocial characteristics have been shown to affect maternal–child interaction. For example, mothers with postnatal depression have been found to exhibit less mutuality and be less responsive towards their children (Murray *et al*, 1996) and the children are less likely to form a secure attachment (Martins & Gaffan, 2000). These

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behaviours are similar to those described in mothers of undernourished children and it is possible that the less stimulating behaviour of mothers of undernourished children is caused in part by poor psychosocial functioning. Mothers of undernourished children have been found to provide less stimulation in the home than mothers of adequately nourished children, the quality of maternal-child interaction has also been found to be poorer (Graves, 1976; Chavez & Martinez, 1982; Sigman *et al*, 1989; Grantham-McGregor *et al*, 1991; Meeks-Gardner *et al*, 1999; Pollitt *et al*, 2000) and their child is less likely to form a secure attachment (Valenzuela, 1990). These maternal behaviours have been found to be related to poor development in undernourished children (Chavez & Martinez, 1982; Sigman *et al*, 1989; Meeks-Gardner *et al*, 1999; Pollitt *et al*, 2000). Poor maternal-child interaction may also contribute to undernutrition. We are aware of only one prospective study which examined this issue and mothers of severely malnourished children were found to be less responsive and affectionate to their children and provide poorer stimulation in the home preceding the onset of undernutrition (Cravioto & DeLicardie, 1976). The quality of caregiving may mediate the relationship between psychosocial function and the child's nutritional status.

Lack of social support and high levels of stressors have also been found to be associated with poor parenting behaviours (Cnic *et al*, 1983; Burchinal *et al*, 1996). There is little information on the level of social support and stressors experienced by mothers of undernourished children in developing countries.

The aims of the study were (1) to compare mothers of undernourished and adequately nourished children on the following: depressive symptoms, parenting self-esteem, stimulation provided by the mother, social support and daily stressors; (2) to examine the independent correlates of stimulation in the home and (3) to examine whether depressive symptoms, parenting self-esteem and stimulation in the home were independently associated with undernutrition controlling for socio-economic variables, stressors and social support.

We hypothesised that (1) the mothers of undernourished children would be more depressed, have lower self-esteem, more stressors, less social support and provide poorer stimulation in the home than mothers of adequately nourished children; (2) psychosocial function would independently predict stimulation in the home after controlling for socio-economic factors and (3) poor stimulation in the home would mediate the effect of poor psychosocial function on nutrition.

Methods

Sample

Samples were chosen from government health centres in the parishes of Kingston, St Andrew and the urban areas of St Catherine in Jamaica. These serve predominantly poor urban

populations. All centers in the areas that had both nutrition and maternal-child health clinics were identified. All children who attend the maternal-child health clinics are weighed and those found to be underweight (weight for age $< -2z$ scores) are routinely referred to the nutrition clinics for more specialised care including monthly weighing, food supplementation and nutritional advice. Only centres with at least 10 children enrolled in the nutrition clinic were included. Two groups, undernourished and adequately nourished controls, were enrolled.

Undernourished group. Undernourished children were identified from nutrition clinic records and all those who were aged between 9 and 30 months and had recorded weights for age less than $-2z$ scores of the National Centre for Health Statistics (NCHS) references (Hamill *et al*, 1977) in the previous 3 months were located and weighed. All children who fulfilled the following criteria were then enrolled: weight currently less than $-1.5z$ scores, birth weight greater than 1.8 kg, singleton birth, absence of chronic disease and/or obvious disability and maternal consent. Eight mothers refused and the remaining 139 children were enrolled. All of the undernourished children had thus been identified by the primary health care personnel as being in need of nutritional surveillance and their mothers invited to attend monthly nutrition clinic.

Control group. In each health centre, every other undernourished child was matched for sex and age group (9-18 months or 19-30 months) with an adequately nourished child attending the maternal-child health clinic. The well-nourished children had a weight for age above $-1.0z$ scores of the NCHS references and no previous record of weight below $-2z$ scores. Seventy-one adequately nourished children were enrolled.

Measurements

Child anthropometry. The children's weight and height or length was measured according to standard anthropometric procedures (Lohman *et al*, 1989). Measurements were conducted by two research assistants and the interobserver reliability (intraclass correlation coefficients) was >0.98 for all measures ($n=10$). Anthropometric measures were converted into height for age, weight for height (WHZ) and weight for age (WAZ) and expressed as z scores of the NCHS references.

Economic background and parental characteristics. The mothers were interviewed at home to obtain information on parental characteristics and family structure. Standard of housing was measured by crowding (number of people per room), a sanitation score (rating of toilet and water amenities summed) and the number of household possessions from a list of 10 items. The mother's vocabulary was assessed using the Peabody Picture Vocabulary Test—Revised

(Dunn & Dunn, 1981). As the test was not standardised for Jamaica, we used the raw score in the analysis. Mother's height was also measured.

Psychosocial function, stress and social support

A questionnaire to measure psychosocial function, stress and social support was administered to 20 non-study mothers on two occasions approximately 2 weeks apart to determine test-retest reliability using intraclass correlation coefficients. In addition, Chronbach's alphas were calculated for each scale to assess internal reliability.

Depression. The depression scale was based on the Centre for Epidemiological Studies Depression Scale CES-D (Radloff, 1977). In addition, three questions were adapted from the Maternal Morale Index used in Barbados (Salt *et al*, 1988; Galler & Harrison, 2000). The CES-D scale was designed to assess the frequency of depressive symptoms in non-clinical populations. After piloting, the wording of the questions was adapted to be more culturally appropriate and several of the questions were omitted. Respondents were asked how frequently they experienced each symptom in the last week and the number of days was recorded. The responses were summed making a summary score of 0–105 representing the number of days of depressive symptoms. Three of the questions were worded in a non-depressed direction to assess positive affect and to avoid response set. These questions were reverse coded and added to the negative items. The test-retest for the depression scale was $R=0.71$, and the internal reliability $\alpha=0.90$.

Parenting self-esteem. Parenting self-esteem encompasses both perceived self-efficacy and the satisfaction derived from parenting (Coleman & Karraker, 1997). Self-efficacy was construed as being situation specific (Bandura, 1989) and 10 items addressed mothers feelings of competence in relation to specific parenting acts such as coping with sickness, feeding and discipline. One item referred to global feelings of efficacy in parenting. For each item, mothers were asked to rate themselves as one of the following: good (3), okay (2), have some trouble (1), not so good (0). These responses were drawn on a ladder, which the mothers used as a visual aid when answering the questions. Parenting satisfaction describes the quality of affect associated with parenting and the degree of satisfaction derived from it. The questions were drawn from the Maternal Morale Index (Salt *et al*, 1988) and the Parenting Stress Index (Abidin, 1986). One example is 'If I could start all over again I would not have children'. A 4-point response scale was used: agree completely (0), agree a little bit (1), disagree a little bit (2) and disagree completely (3). Questions worded in a negative direction were reverse coded.

Item scores for the satisfaction and self-efficacy subscales were summed to yield a parenting self-esteem score of 0–51. The scale had a test-retest of $R=0.95$ and a Chronbach's alpha of 0.81.

Social support. This scale measured tangible and emotional support and was based on the Medical Outcomes Study Social Support Survey (Sherbourne & Stewart, 1991) which was designed for use in the general population. Mothers were asked if they received specific types of support on a 5-point scale: no (0), a little of the time (1), sometimes (2), most of the time (3), always (4). The response set was also presented on a pictorial ladder. Responses were summed to form a cumulative score of 0–20. The test-retest for the scale was $R=0.86$ and the internal reliability was $\alpha=0.66$.

Stressors. The stressors questionnaire was designed for this study and comprised nine questions. The questionnaire included some of the most common problems faced by low-income Jamaican mothers. These were violence in the community, yard (group of houses around a common space) and household, food security, insufficient income and stressful interpersonal relationships. The test-retest for the sum of the items in the stressors scale was $R=0.95$. Factor analysis of the items in the questionnaire produced four factors which explained 75% of the variance. These concerned economic stress (eigenvalue=2.7), partner stress (eigenvalue=1.3), domestic violence (eigenvalue=1.1) and community violence (eigenvalue=1.0).

Home Observation for Measurement of the Environment (HOME) Scales. The HOME questionnaire (Caldwell & Bradley, 1979) was developed in the United States and measures the responsiveness and stimulation of the home environment through a combination of systematic observations and maternal report. The HOME has been modified for use in Jamaica previously and was found to be associated with current and future development (Grantham-McGregor *et al*, 1991; Meeks-Gardner *et al*, 1999).

For this study, further adaptations were made which included the addition of more questions relating to activities the mother does with the child and the extension of the response scale of the maternal report items from a dichotomous response to a 6-point scale: never or less than once a week (0), once a week (1), 2–3 times a week (2), 4–6 times a week (3), every day (4), more than once a day (5). These adaptations resulted in a larger range of scores, thus making the instrument more sensitive to small differences in the homes.

We retained the dichotomous scoring (behaviour occurred or not) for the observations. All items were coded so that a high score indicates more appropriate maternal behaviour. Total HOME scores were obtained by summing the items giving a range of 0–96. Only the maternal reported questions were repeated for test-retest as it was not feasible to do home visits at that time. Test-retest was $R=0.92$ and the chronbach's alpha was $\alpha=0.80$.

Interobserver reliability. One interviewer administered the questionnaires in the mothers' homes. Interobserver reliabilities between trainer and interviewer were > 0.9 for each

scale in 10 consecutive interviews prior to the study and in ongoing quality control of 10% of interviews.

Ethical consent. Ethical consent was given by the University of the West Indies Medical Sciences Ethics Committee and the Ministry of Health in Jamaica.

Analysis

All variables were checked for normality. The depression score was negatively skewed so was normalised with a square root transformation. The social support score was positively skewed and was transformed by squaring. Factor analysis was used to identify the underlying constructs in the stressors scale and the factor scores were used in the analysis.

Independent samples *t*-tests for continuous variables and chi-squared analysis for categorical variables were performed to determine the difference between the undernourished and adequately nourished groups. Correlation coefficients (Pearson's product moment or Spearman's rank) were computed to examine the relationship between nutritional group, home stimulation and all variables in Tables 1–3. In order to determine the independent risk factors for under-nutrition we conducted a logistic regression of nutritional group offering all variables that were significantly different between the groups. Stepwise multiple regression analysis

was used to determine the independent predictors of stimulation in the home.

Results

All the measurements were completed.

Differences between the nutritional groups

Background variables. There was no difference between the undernourished and adequately nourished children in birth order or age (Table 1). As expected there were significant differences in their weight for age, height for age and weight for height. In the undernourished group, 67 of the children (48%) were moderately underweight ($WAZ < -2z$ scores) and 14 (10%) were severely underweight.

There were no significant differences between the groups in maternal age, education, marital status or the number employed (33%) (Table 2). The mother's mean age was 26 years and more than half of them had not completed secondary education. Few of the mothers (13.9%) were married. Fewer of the undernourished children's fathers lived with them than in the adequately nourished group ($P < 0.001$). The undernourished group had significantly worse sanitation scores ($P < 0.05$) and fewer possessions ($P < 0.001$), but there was no difference in crowding. Compared with the controls, the mothers of undernourished

Table 1 Child characteristics on enrollment by nutritional group (mean \pm s.d.)

	Underweight (n=139) Mean \pm s.d.	Adequate weight (n=71) Mean \pm s.d.
Age on enrolment (months)	18.53 \pm 4.98	19.38 \pm 4.80
Birth order	2.29 \pm 1.60	1.97 \pm 1.22
^a Weight for height (z score)**	-1.64 \pm 0.62	0.03 \pm 1.04
Weight for age (z score)**	-2.22 \pm 0.53	0.14 \pm 1.00
Height for age (z score)**	-1.57 \pm 0.92	0.36 \pm 0.89

^a*t*-test of transformed variable.

** $P < 0.001$.

Table 2 Family characteristics on enrollment by nutritional group (mean \pm s.d.)

	Underweight (n=139) Mean \pm s.d.	Adequate weight (n=71) Mean \pm s.d.
Sanitation*	7.84 \pm 3.05	8.71 \pm 2.96
Possessions**	5.13 \pm 1.98	6.17 \pm 1.82
Mother's PPVT*	93 \pm 21.27	100 \pm 25.12
Mother's height**	159.3 \pm 5.9	163.8 \pm 6.8
Baby's father living there %**	41.0	65.7
Mother's work* %		
Non/unskilled	36.7	19.1
Semi-skilled	42.4	44.1
Skilled	20.9	36.8

* $P < 0.05$, ** $P < 0.001$.

Table 3 Maternal characteristics and experience and home stimulation by nutritional group (mean \pm s.d. and median (range))

	Underweight (n=139) Mean \pm s.d.	Adequate weight (n=71) Mean \pm s.d.
Self-esteem*	32.2 \pm 8.3	35.4 \pm 8.2
HOME**	46.7 \pm 12.4	50.8 \pm 14.0
	Median (range)	Median (range)
^a Depression*	26 (0–91)	16.5 (0–86)
^a Social support	16 (1–20)	17 (3–20)
^b Economic stress index***	3 (1–10)	1 (1–10)
^b Partner stress index	3 (1–7)	3 (1–7)
^b Domestic violence index	1 (1–6)	1 (1–5)
^b Community violence index	2 (1–4)	2 (1–4)

* $P < 0.01$, ** $P < 0.01$, *** $P < 0.001$.^a t -test of transformed variable.^b t -test of factor score.

children had poorer PPVT scores, lower skilled occupations (both $P < 0.05$) and were shorter ($P < 0.001$).

Maternal psychosocial characteristics and experiences and home stimulation. The mothers of undernourished children had significantly more depressive symptoms and lower parenting self-esteem than the mothers of adequately nourished children (both $P < 0.01$) (Table 3). They also reported higher levels of economic stress ($P < 0.001$). There were no differences between the groups in partner stress, domestic violence, community violence or social support. They also provided a less stimulating home environment for their child ($P < 0.05$).

Variables associated with home stimulation

The HOME is a broad indicator of quality of parenting. Higher scores on the home were associated with increased maternal schooling ($r = 0.16$, $P < 0.05$) and verbal intelligence ($r = 0.36$, $P < 0.001$), less crowding ($r = -0.16$, $P < 0.05$), more possessions ($r = 0.21$, $P < 0.01$) and presence of the baby's father ($r = 0.19$, $P < 0.01$). Higher scores on the HOME were also associated with lower maternal depression ($r = -0.17$, $P < 0.05$), higher maternal self-esteem ($r = 0.33$, $P < 0.0005$), less economic stress ($r = -0.19$, $P < 0.01$), less partner stress ($r = -0.17$, $P < 0.05$), less domestic violence ($r = -0.17$, $P < 0.05$) and more social support ($r = 0.22$, $P < 0.01$). In order to determine if the mother's psychosocial characteristics independently predicted the HOME scores, depression and self-esteem along with nutritional group and other significant correlates were offered stepwise in a multiple regression. The variables independently associated with the HOME were higher maternal verbal IQ, higher parenting self-esteem and decreased levels of partner stress

Table 4 Standardised beta coefficients (β) and amount of variance explained (R^2) from multiple regression of stimulation in the home with groups combined

	Adjusted R^2	β
PPVT***	0.12	0.36
Self-esteem***	0.23	0.30
Partner stress**	0.25	-0.16
		F = 23.39***

** $P < 0.01$, *** $P < 0.001$.

(Table 4). These variables accounted for 25% of the variance in HOME scores. Interaction terms between group and the significant covariates were also offered but were not significant.

Logistic regression of nutritional group

We examined the independent risk factors for undernutrition in a logistic regression of nutritional group. The variables which were significantly different between the groups were offered stepwise (possessions, sanitation, maternal height, skill level of work, depression, self-esteem and verbal IQ, the presence of the baby's father, economic stress, stimulation in the home). The independent predictors for being undernourished were low maternal height, higher levels of economic stress, lower skill level of work, the baby's father not living in the household and fewer possessions. The model correctly placed 77.7% of the sample. The odds ratios and 95% confidence intervals are given in Table 5.

Table 5 Logistic regression on nutritional group

	Odds ratio	95% confidence interval
Maternal height	0.893	0.845, 0.944
Economic stress	1.623	1.051, 2.508
Skill level of work	0.692	0.489, 0.979
Father not there	2.162	1.087, 4.301
Possessions	0.830	0.687, 1.002

77.7% placed correctly (89.9% undernourished and 52.9% adequately nourished; 1 = undernourished, 0 = adequately nourished).

Discussion

In keeping with our first hypothesis, mothers of undernourished children reported more depressive symptoms, had lower parenting self-esteem and more economic stress than mothers whose children were adequately nourished. There was however no difference between the groups in the availability of social support and in stressors relating to the mother's partner and domestic and community violence. Depression in this study refers to the frequency of depressive symptoms rather than to clinical depression and so mothers with high scores may not be clinically depressed. We did not use cut off points due to difficulties in transferring across cultures. All the measures used in the study had good interobserver reliability and good test-retest over a 2-week period. The scores were also correlated with other measures in a theoretically sensible way, which promotes confidence in the validity of the measures.

It was not surprising that the mothers of undernourished children scored lower on economic variables than mothers of adequately nourished children. They were also less likely to live with the baby's father which is consistent with other studies in the literature (Goodall, 1979; Dixon *et al*, 1982).

The mothers of undernourished children in this study provided a less stimulating home environment for their children than the control group. Self-esteem and partner stress were independent predictors of the level of stimulation in the home indicating that the psychosocial status of the mother and the level of daily stressors experienced affected the quality of the child's home environment. Hence, there was an independent association between maternal psychosocial function and stimulation in the home in accordance with our second hypothesis. Maternal IQ was the only other variable to contribute to home stimulation.

Contrary to our third hypothesis, neither mothers' psychosocial function nor home stimulation were associated with being undernourished once environmental factors were taken into account. The environmental factors predicting nutritional group were economic stress, low skill level of occupation, fewer possessions and absence of the baby's father which are all indicators of poverty. Mother's height was also independently associated with nutritional group and in this population reflects the intergenerational cycle of poverty, that is, women who are stunted in early childhood due to undernutrition are more likely to be poorer and have

children who are undernourished. Although the mothers in the sample all came from poor neighbourhoods, which would have limited the variance in economic status, indicators of poverty were still the most powerful predictors of nutritional status. We had hypothesised that stimulation in the home may mediate the relationship of psychosocial function with nutritional status but this was not the case in this population.

Little attention has been paid to the psychosocial function of mothers of undernourished children. Maternal distress, a combination depression, anxiety and psychosomatic problems has been found to be associated with behaviour problems in preschool and school-aged children (McGee *et al*, 1984; Sommerfelt *et al*, 2001.). Depression of the mother has also been found to be associated with poor school achievement (Salt *et al*, 1988) and cognition (Peterson & Albers, 2001).

We had no measures of child development in the present study but it is likely that the increased frequency of maternal depressive symptoms and less stimulating environment experienced by undernourished children would be associated with poorer mental development. The association between home stimulation and development has been demonstrated in other studies in Jamaica (Grantham-McGregor *et al*, 1991) and other developing countries (Grantham-McGregor *et al*, 1998).

Most of the undernourished children in this study were only mildly to moderately undernourished. In countries where poverty and malnutrition are more severe, poor psychosocial function is probably a greater problem and could have a serious impact on children's development.

In conclusion, mothers of undernourished children had more depressive symptoms and poorer self-esteem than mothers of adequately nourished children. These differences were explained by more stressful environments. They also provided a less stimulation in the home for their children, that was partly explained by poor self-esteem. It is thus important that when treating undernourished children, attention is paid to the psychosocial status of the mother and to potential stressors in their environment.

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