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The Biocultural Approach in Nutritional Anthropology: Case Studies of Malnutrition in Mali

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Medical anthropological research dealing with nutritional issues is, almost by definition, biocultural in its approach. What foods people eat and how much they eat are determined not simply by hunger, a biological drive, but more importantly by political-ecological factors that determine the availability of food and cultural factors that shape the acceptability and preparation of food As we saw in selection 4 by Reynaldo Martorell, which questioned the "small but healthy" hypothesis, nutritional anthropologists must be concerned about measures of childhood growth and development. Such measures reflect the biological consequences of nutritional intake. Researchers can assess the nutritional status of children by using standards, like the National Center for Health Statistics (NCHS) standards used in this selection

Undernutrition takes two forms First is overall protein and calorie deficit, as described here in case studies from the African country of Mali. Marasmus, a type of overall wasting, and kwashiorkor, an illness of protein deficiency often related to weaning, are particular types of malnutrition In the poor countries of the world, there is a well-documented relation between undernutrition and infectious disease Poorly nourished children have a harder time recovering from bouts of infectious disease, while at the same time illness episodes slow growth rates This situation is often found in relation to inappropriate infant formula feeding wherein babies may be given an extremely diluted solution of "milk" made with water that is full of pathogens The interaction of disease and malnutrition means that underweight children are more likely to die, as was sadly noted by the Brazilian shantytown mothers studied by Nancy Scheper-Hughes in selection 40.

Malnutrition can also be the result of the lack of a specific micronutrient such as iodine or vitamin A; a severe deficiency of iodine, for example, can result in goiter and mental retardation (Fernandez 1990; Green 1977). Such consequences can be avoided by relatively simple programs of adding iodine to salt. Whether such well-aimed "magic bullets" will do much to solve problems of world hunger, however, is another question.

In this selection, Katherine Dettwyler provides individual case studies of child malnutrition in Mali. These are like the cases she describes in her book of anthropological fieldwork, Dancing Skeletons (1994). Mali is one of the poorest countries of the world, and as a consequence both child malnutrition and death rates are very high. This selection demonstrates that the relationship between socioeconomic status and malnutrition is not simple, for some of the cases here are the children of low-status mothers within a relatively prosperous extended family household. The vast majority of malnutrition in Third World countries does not have a single identifiable cause Local agricultural production and the marketing of food are central factors, but issues regarding the status of women or cultural rules about child feeding also must be considered

As you read this selection, consider these questions

- *What are the particular situations of these Malian mothers and children that result in child malnutrition and early death? In any one of these cases, how might these tragic outcomes have been avoided?*
- *Why is this study of malnutrition considered biocultural? Are there cultural factors that might not get included in regular nutrition surveys?*
- *What does the author mean when she says that in many instances children are severely malnourished because they "have fallen through the safety net of overlapping support systems that normally ensure a minimum level of nutrition and health for children in the community"? Why is she impressed that the traditional system is actually working?*
- *Do you think it is relevant that two of the case studies are of twins?*

Socioeconomic status is often cited as the most important factor influencing nutritional status in children, and, in general, national rates of malnutrition are negatively correlated with per capita income As Pryer and Crook (1988 5) have stated, "Appalling environmental conditions and intense poverty are likely to be the two most important determinants of health and nutritional status of the slum and shanty town dwellers in many of the cities of the developing countries " Although not disputing this conclusion, a number of ethnographic studies have highlighted the role that cultural beliefs and practices regarding infant feeding and care also play in determining health and nutritional status in young children (Daniggelis 1987a, 1987b; Guldan 1988; Hull and Simpson 1985; Marshall 1985; Zeitlin and Guldan 1988)

The work of Zeitlin and her colleagues has focused on the role of psychosocial and behavioral aspects of child care and feeding in determining "positive deviance" in child health—those children who manage to thrive under conditions of environmental adversity (see Zeitlin, Ghassemi, and Mansour 1990 for a review of the literature on positive deviance) Others have focused on attributes of those children who fare particularly poorly under such conditions, including how they are perceived by their caretakers For example, in a study of childhood deaths in northeastern Brazil, Scheper-Hughes found that mothers "gave up" on severely malnourished children and neglected them until they died (Scheper-Hughes 1987) Likewise, Mull and Mull report that among the Tarahumara of Mexico, children who are perceived as being "handicapped" may be allowed to starve to death, or are killed outright (Mull and Mull 1987). In Kenya, de Vries (1987) found that Masai infants who cry a lot are perceived as being fighters, with the personality and will necessary to survive the harsh conditions of life These children are given more attention and nursed more often than quiet, placid babies The quieter babies thus suffer and die more often from malnutrition.

The work of Bledsoe, Ewbank, and Isiugo-Abanihe (1988) and Bledsoe (1991) has focused on intrahousehold food distribution patterns and the effect of being a foster child on access to food and health care resources, growth, and health among the Mende of Sierra Leone Bledsoe finds that, compared to "born" children of the household, young "fosters" have less access to food resources but are expected to perform more labor (Bledsoe 1991) Fosters also suffer more from malnutrition, but are taken to the hospital less often than "born" children (Bledsoe, Ewbank, and Isiugo-Abanihe 1988)

These examples could all be described as instances of "socio-cultural malnutrition," a term coined by Gokulanathan and Verghese to refer to growth failure in children that is "due to factors other than poverty and the lack of availability of food materials" (1969 118) Research in Mali (West Africa) suggests that sociocultural malnutrition contributes to the overall malnutrition picture A number of studies in Mali have compared expenditures for food and dietary intakes of groups at different levels of socioeconomic status and from different parts of the country. All of these studies have concluded that relative income is not closely related to diet in Mali (Diakite 1968; Clairin et al 1967; May 1968; Mondot-Bernard and Labonne 1982) Members of all social classes consume the same foods in the same quantities, and rising income is not correlated with an increase in quantity or an improvement in the nutritional quality of the diet.

In 1982 and 1983, and again in 1989, the author conducted research in a periurban community in Mali, focusing on the relationship between infant/child feeding beliefs and practices and the growth and development of children The 1982–83 research was based on a mixed-longitudinal study of 136 children under four years of age The 1989 research included a follow-up study of the children in the earlier sample. Previous publications based on this research have described the systems of beliefs concerning infant and child feeding practices (Dettwyler 1985, 1986), breastfeeding and weaning (Dettwyler 1985, 1987), the role of anorexia in malnutrition (Dettwyler 1989a), infant feeding styles (Dettwyler 1989b), and the relationship between relative poverty and nutritional status and growth in the entire sample (Dettwyler 1985, 1986)

Treating the growth data in cross section, average growth for all children in the 1982–83 sample during the first three years of life corresponds closely to the fifth percentile of NCHS standards (Hamill et al. 1979; . .) A few children were growing at or above the NCHS fiftieth percentile, even though they came from relatively poor families (cf "positive deviants," Zeitlin, Ghassemi, and Mansour 1990), while others were well below the fifth percentile, including some from relatively well-off families. The children in the latter group can be described as having fallen through the safety net of overlapping support systems that normally ensure a minimal level of nutrition and health for children in the community

The data clearly indicate that relative poverty is not an accurate predictor of the observed variation in nutritional status and growth in this community, and that differences in maternal attitudes, experience, and other factors are responsible (Dettwyler 1986) In Mali, these factors include maternal age, marital problems, untreated illness, allocation of household resources, maternal attitudes, maternal competence and experi-

ence, support networks, and the position of the mother within the social structure of a polygynous, patrilineal society In this paper, case studies of three families from the research community illustrate how sociocultural malnutrition in young children in Mali can be viewed as a consequence of the interactions among many factors It is hoped that the case studies will demonstrate the value of a biocultural approach in which detailed ethnographic data, gathered in conjunction with traditional anthropometric measurements, can illuminate the intricate interactions between culture and biology

DEMOGRAPHIC AND ETHNOGRAPHIC BACKGROUND OF THE SAMPLE

The study community of Farimabougou (a pseudonym) is one of approximately ten periurban communities located across the Niger River from the capital city of Bamako. During 1982 and 1983, a sample of 136 children were visited every four to eight weeks. The sample was constructed in a flexible, random manner, by walking the streets of the community, looking for families with young infants (not yet eating solid foods), explaining the project, and recruiting families willing to cooperate over an extended period of time. The study compounds were widely distributed and included all sectors of the community A few infants, usually from neighboring compounds, were added to the study at the request of their mothers Only three families dropped out of the study due to lack of interest. Several families were dropped because the index infant died during the measles epidemic that occurred during the initial month of the study The final sample of 136 children came from 117 compounds and included 20 sibling pairs

Growth data were collected at each visit, and multiple, semistructured interviews of mothers and other caretakers, as well as participant-observation of child feeding activities, were used to collect data on infant feeding beliefs and practices and infant health Growth data included anthropometric measures of weight, and of arm, head, and chest circumference, as well as number of teeth erupted and general stage of motor and language development. Exact ages were determined from birth certificates, and the records of the local maternity clinic provided birth weights for some of the children.[1] All interviews were conducted by the author in Bambara, the native language of most of the informants, with the assistance of a Malian interpreter. A follow-up study of the same children was conducted in 1989. Approximately half of the children were relocated, measured again when possible, and their mothers interviewed again

A brief description of the community will provide a wider context for the case studies that follow Traditionally, the Malian economy has been based on subsistence agriculture. Bamako and Farimabougou, however, operate primarily on a cash economy. Most food is purchased in the daily market using cash obtained from the wage labor of fathers and, occasionally, mothers. Farimabougou is a poor community. In 1979, the World Bank defined the "urban poverty threshold" for Bamako as approximately $60.00 per month per household, and reported that the average income in Farimabougou is 40 percent lower than that of Bamako, with almost half of the households in Farimabougou below the urban poverty threshold (World Bank 1979).

In terms of ethnic identity, the parents of children in the study identify themselves primarily as Bambara or Mandinka (67%); the rest are divided among Fulani, Senoufo, Songhrai, Bobo, and Dogon. According to information provided by the Institut du Sahel (T. T. Kane, pers. comm. 1989), in 1989 Mali had a crude birth rate of 47/1,000 and a crude death rate of 20/1,000, resulting in a natural growth rate of 2 7 percent. The infant mortality rate was 130/1,000, and the juvenile mortality rate was 159/1,000 Life expectancy at birth was 47 years The average number of births was 6 7 per woman Data for these variables specific to Farimabougou do not exist

During the 1982–83 study in Farimabougou, the average age for the introduction of solid foods was 7 9 months, with 14 4 months as the average age when children began eating the adult staples (millet and rice) The average age of weaning was 20 8 months, and women experienced an average duration of lactational amenorrhea of 10 1 months The average pregnancy interval was 19.4 months, and the average interbirth interval was 26.5 months

Two of the case studies reported here involved twins. According to local maternity clinic records, the rate of twinning in Farimabougou was 17.8/1,000 births in 1981 and 1982; this is almost identical to the rate reported by Imperato for the Bambara and Mandinka (17 9/1,000). According to Imperato:

> Twin births are extremely common among the Bambara and Malinke . Because twins are regarded among the Bambara and the Malinke as a blessing bestowed by the supreme being, their birth is received with great rejoicing (Imperato 1977:119)

In terms of child care in general, and infant feeding practices in particular, twins are not treated differently

from single births Twins often start life smaller than singleton births, and must share one mother's milk In two of the case studies below, being a twin undoubtedly adds yet another risk factor for malnutrition At the same time, other sets of twins in the sample survived and flourished.

In 1982–83, the houses in Farimabougou were mostly of mud-brick construction with corrugated iron roofs and were located inside mud-walled compounds that were closely packed along narrow dirt streets. Compounds had neither running water nor electricity. Each compound had a pit latrine. Household garbage was thrown into a pit inside the compound, or out into the street.

The Malian diet is based on millet and rice, accompanied by various sauces Animal protein in the diet comes from beef, mutton, or fish, which are often pounded before being added to the sauce According to several food consumption surveys, with the exception of years of severe drought and of certain areas of far northern Mali, adult Malians have an adequate diet (Clarin et al 1967; Diakite 1968; May 1968, Mondot-Bernard and Labonne 1982)

The traditional social organization of the Bambara consists of extended families living in large compounds, polygynous marriages, patrilineal descent, and patrilocal residence (N'Diaye 1970) This type of compound social organization is seldom realized in Farimabougou Usually only one adult male from a rural family migrates to the city, and he usually has only one wife due to economic constraints Thus, most of the children in the larger sample came from parents in monogamous marriages and lived in compounds containing only nuclear family members

Except for a few Christian families, the people of Farimabougou are Moslem For the most part, however, women do not strictly follow Muslim teachings They are not secluded, they seldom go to the mosque or pray at home, they rarely fast during Ramadan, and they are not familiar with Koranic guidelines concerning infant feeding. Islamic beliefs coexist with traditional religious beliefs and practices Sickness and death are usually attributed to Allah rather than to organic causes, witchcraft, or sorcery

The majority of women who participated in the study were born in rural villages and had lived in the urban environment for less than 20 years at the time of the initial study They have had little or no formal education, speak Bambara but not French, and can neither read nor write.

Health services for the residents of Farimabougou are provided primarily by traditional herbalists who sell leaves in the market, and by a government-run PMI (maternal/child health center) located approximately three kilometers away Although the PMI visits are free, the numerous medicines that are usually prescribed are very expensive Most children are born at the PMI, but mothers do not often take sick children to the PMI for treatment, preferring to try traditional cures first. The nearest hospital is located in downtown Bamako, at least 20 minutes away by public transportation. In 1982–83, few children had been vaccinated against any of the major childhood diseases, and oral rehydration solution as a treatment for diarrhea was virtually unknown. Measles, malaria, upper respiratory infections, and diarrhea were the major illnesses of young children. According to Imperato, who has written in detail about traditional Bambara beliefs concerning measles:

> Measles is the most important disease of childhood in Africa It occurs throughout the continent, the incidence being highest in most areas every third year. Measles epidemics occur at the peak of the dry season in West Africa, from March through May, when stores of food and human nutritional levels are at their lowest From 1958 through 1975, the annual number of measles cases reported in Mali has ranged from 10,000 to 40,000, with case mortalities of 15–20 percent (Imperato 1977:138)

A serious outbreak of measles occurred during the initial study in May of 1982 There were only a few cases of measles in 1983

Malaria affects children primarily during the rainy season (July–September). Only one child death was attributed to malaria during the initial study. Of the seven child deaths that occurred between the two studies, four were reported to be due to malaria, and three to measles

In general, women welcome new pregnancies Children are viewed as a source of wealth and prestige, the more children you have, the higher the family income will be, the more people there will be to support you when you are old, and the higher your status as a wife. Infertility is considered a tragedy The Bambara believe that it is good luck to have a female child first, but both male and female children are valued The growth data as well as interview data reveal no significant sex bias in terms of nutrition or health care Thus, being a female is not a risk factor for malnutrition in this community. Although children are highly valued, there is little understanding of the importance of proper nutrition and health care during the first few years of life. Infant mortality rates are very high, and mothers seem resigned to the fact that many children die, even if you "search for medicine" for them It is considered to be a much greater loss if an older child or an adult dies than if a young infant dies

Compared to conditions in 1983, Farimabougou had changed little by 1989. Treated water was available

from common stand-pipes located on the main roads, but most people continued to obtain water from the wells in their compounds The community still lacked electricity, sewage treatment, and garbage disposal service. The major noticeable physical change was a building boom on the periphery of the community. Although construction of many houses has begun, few are completed. Block after block of half-finished cement houses, destined to be middle-class neighborhoods, surround the original mud-brick community.

In terms of health care, several changes were apparent. One is that many of the children under 3 years of age had been vaccinated against measles, tetanus, polio, and tuberculosis, primarily by a traveling van of health workers who visit the market periodically. Women said that measles no longer kills many children, and that only a few children in Farimabougou died of measles during the hot season of 1989 Women were still reluctant to take children to PMI for immunizations, however. The local PMI had acquired a bad reputation among mothers because of long waits and "rude treatment" by the health workers, and was used even less than it was in 1983 By 1989, many mothers had heard of oral rehydration solution, and approximately 10 percent reported that they use it for the treatment of diarrhea in young children Other women still used traditional herbal cures for diarrhea or did not treat diarrhea at all

The three case studies given here, involving seven children, represent children with some of the poorest growth in the sample Their growth data are not as complete as those of some of the other children for several reasons Often the children were too sick or miserable to measure, and one child died early in the study. However, their family situations, though unique in their specific combinations of factors, are not atypical These case studies clearly illustrate that malnutrition is often the result of a complex set of factors acting in combination

CASE STUDIES

Case Study 1: Children #5 and #6

Children #5 and #6 were fraternal twins, a boy named Al-Hassane and a girl named Assanatu (all the names have been changed). Birth records in the local PMI record their birth weights as 2.2 and 1 5 kilos, respectively; the records do not indicate if the twins were premature. Jeneba, the twins' mother, had been married before and given birth to four children. Two were still alive and lived with their father's brothers. The other two, a set of twin boys, had died at 6 months of age from diarrhea, according to Jeneba After her first husband died in 1980, Jeneba remarried, she gave birth to Al-Hassane and Assanatu in 1981 Her second husband was a widower with teenaged children from his first marriage. He was employed at the national airport in a salaried position, but his wife did not know how much money he made.

Al-Hassane and Assanatu entered the study at the age of 8 months. . . . At 8 months of age, both children fell below the fifth percentile of NCHS standards for weight-for-age. The boy's weight, 6 3 kilos, falls in the "moderately malnourished" category according to the World Health Organization's system of classification by standard deviations below the median (between 2 and 3 SD below the median). The girl's weight, 5.0 kilos, places her in the "severely malnourished" category, more than three standard deviations below the median for her age. The children were receiving only breast milk at this time, although the girl sometimes ate a little millet porridge. The mother reported that because she had insufficient breast milk for twins, she had occasionally given them formula as a supplement when they were younger However, their father had stopped providing money for this purpose

At the next visit, when the children were 9 months of age, their mother was sick with malaria The children were still nursing, and both had begun to eat solid food on a regular basis during the previous month They had eaten no solid food for two days, however, because the mother was too ill to cook and had no one to help her. Pryer and Crook have noted that in urban regions of Third World Countries, "adults who are ill or malnourished are very likely to be unable to cope with the time-intensive demands of child care" (Pryer and Crook 1988) Jeneba's husband's older children, from his first marriage, were cooking for him and for themselves, but would not help their stepmother care for her children At this visit, Al-Hassane's weight had dropped to 5 5 kilos, while Assanatu's had remained at 5 0 kilos Both children now fell into the "severely malnourished" category

At 10 months, the boy's weight had returned to 6 0 kilos, but the girl's remained at 5 0 kilos A 24-hour dietary recall revealed that for breakfast they had eaten millet porridge flavored with sweetened condensed milk For lunch, they had rice flavored with beef bouillon cubes; in the late afternoon, they had eaten some boiled sweet potatoes According to their mother, they had not eaten any dinner the night before, because they were already asleep when the meal was served. She said that they were usually asleep when the evening meal was prepared.

At 11 months, Al-Hassane had regained his 8-month weight of 6.3 kilos, but Assanatu still had not

gained any weight At 12 months, the children were sick with fever and diarrhea, but both had gained a little weight since the previous month At 15 months, Al-Hassane had lost 1 0 kilo of weight since the previous visit. His mother said he had been chronically ill with fever and diarrhea caused by teething and had refused to eat any food for the previous month Assanatu had not been sick and had gained 0 5 kilo during the preceding three months. At this visit, the mother confided that she was thinking of leaving her husband because they were not getting along She was especially upset over her stepchildren's refusal to accept her or her children as part of the family, and their refusal to help with the domestic labor

The next month when I went to visit the compound, I was told that Jeneba had indeed taken the twins and left After four months, I relocated them at her first husband's compound At 19 months, Al-Hassane weighed 8.6 kilos (moderately malnourished), a gain of more than 3 0 kilos in four months This weight gain represents marked catch-up growth in response to the changed environment, especially an improvement in diet; normal weight gain for males between 15 and 19 months is 0 80 kilos Assanatu had gained 1 1 kilos in the same time period, which also represents some catch-up growth; normal weight gain for females is 0 75 kilos However, at 7 1 kilos, she was still classified as "severely malnourished "

Jeneba said they had been completely healthy ever since she had moved She now had access to money to provide them with proper food, as well as help with the domestic labor, and emotional support from her relatives Her first husband's family was providing money for food and medical care A 24-hour dietary recall at this time revealed that they had eaten rice porridge with sugar for breakfast At the morning market, they had eaten meat brochettes (small pieces of beef cooked on a skewer) For lunch, they had rice with fish and onion sauce, with leftovers in the late afternoon At night, they had eaten millet porridge

Assanatu was always significantly smaller than her brother, especially for head circumference Her weight gains and losses were never as dramatic as Al-Hassane's either. However, she was slightly advanced in motor development, suffered less from teething, and generally seemed more alert and happy These differences may reflect the tendency of females to be less affected by stressful environmental conditions than males (Stini 1985, Stinson 1985) Assanatu seemed to respond by not growing in size, but continuing to advance developmentally. Al-Hassane was bigger, but developmentally delayed Both children seemed to be treated the same by their mother, in terms of access to food and medical resources

Follow-Up In 1989, contact was re-established with the family According to Jeneba, Al-Hassane died at 3 years of age, when he had the measles Assanatu had the measles at the same time, but recovered Today, at almost 8 years of age, Assanatu's weight of 18 6 kilos is below the fifth percentile of NCHS standards. She would be considered "mildly malnourished" by the WHO classification. Her height, 121 0 centimeters, is just below the twenty-fifth percentile of NCHS standards, well within "normal" limits The main legacy of her early childhood malnutrition is a small head circumference. Most brain growth occurs during the first 3 years of life, and inadequate nutrition during this time cannot be overcome by improved conditions in later childhood. Assanatu's head circumference, 47.3 centimeters, is the median for a child of only 18 months by NCHS standards, and falls well below those of the other girls her age in the follow-up study, whose head circumferences range from 49 to 53 centimeters. Her mother reports that she is "not very smart," and although she went to Koranic school for a while, she no longer attends "because she couldn't keep up " She also reports that Assanatu suffers often from malaria, and "doesn't like to eat very much " Jeneba never returned to her second husband, and he provides no support for Assanatu They still live with her first husband's family, along with a man to whom Jeneba is not legally married She has had one child with this man, and is now pregnant with her eighth child

In this case, a variety of factors combined to provide a less than satisfactory environment for proper growth for the twins In addition to beginning life with low birth weights and having to share their mother's breast milk, the twins did not receive supplementary solid foods on a regular basis until 9 months of age, by which time both were already severely malnourished. The late addition of solids to the diet is typical of this community Although their father had a steady, salaried job, their mother had little direct access to this income, she was dependent on her husband's good will and could not always count on money for formula to supplement her breast milk Marital discord led her to return to her first husband's family Even though the twins belonged to a different patrilineage, her first husband's family welcomed them and provided help with child care, as well as financial and emotional support The twins responded with substantial catch-up growth and improved health. Al-Hassane's poor nutritional status during the first 2 years of life undoubtedly played a role in

his death from measles at the age of 3 years, and Assanatu's early deprivation has led apparently to some mild, but probably permanent, mental deficiencies

It is interesting to speculate on the different paths taken by these two children Assanatu seemed to conserve her resources through poorer physical growth Did this allow her to survive by reserving scarce resources for fighting disease? Did Al-Hassane's strategy of spending resources on growth mean that there were insufficient resources for fighting disease? If so, how do we account for individual or population differences in resource allocation?

Assanatu's functional impairments affect her directly, but they also affect her family and the society at large. She will never be able to make as much of a contribution as she might have if she had been adequately nourished, and this observation holds for many children who survive severe cases of early childhood malnutrition

Case Study II: Children #76 and #77

Children #76 and #77 were a set of identical twin girls, named Fatoumata and Oumou They were their mother's first and second children Their mother, Aminata, was approximately 16 years old, and unmarried. The twins' father, who had not been allowed to marry her, did not contribute anything to their support Aminata lived in a large compound containing one elderly woman, this woman's four adult sons, and their wives and children Aminata was the foster child of a wife of one of the adult men in the compound

I first encountered the twins when they were 14 months of age They were never officially part of the growth study, but lived in the compound next to a family that was, so I saw them on a regular basis. They were not included in the official growth study for several reasons First, the original sample was constructed to maximize the spread of families throughout the town, and I tried not to include immediate neighbors. Second, the twins were often so sick and miserable that it seemed unkind to bother them by taking measurements Third, and most important, I was conducting a naturalistic study of traditional Malian patterns of infant feeding and their effects on growth and development. In this case, I often gave Aminata advice, and occasionally money to buy fish, and for several months I brought her home-made formula (powdered milk, sugar, oil, water) In addition, when the twins had the measles, I bought the ingredients for oral rehydration solution and showed Aminata how to mix and administer it Thus, the twins' growth after 14 months of age reflected in part my efforts on their behalf. Their growth data are included in the summary statistics for the sample reported elsewhere Despite the paucity of growth data, and my interventions, their case is described here because it provides a particularly clear illustration of the constraints placed on women and their children by the social structure of a patrilineal society.

The twins were born at home, so birth weights are not available. I did not measure them when I first met them at 14 months of age. At 15 months of age, during the hot season, both twins caught the measles. Fatoumata had an especially serious case, probably because she was already more severely malnourished than her twin. For two weeks neither twin ate any solid food, and both became dehydrated. I provided oral rehydration solution and tried to convince their mother to take them to the hospital, but she refused. They eventually got better, though it took several months for them to recover fully and begin eating normally again. Following their bout with measles, at 19 months of age, Fatoumata weighed 4 2 kilos, which is more than five standard deviations below the median of the NCHS standards (anything more than 3 SD below the median is considered "severely malnourished") Her sister Oumou weighed 5 9 kilos, which is between four and five standard deviations below the median. . .

Although I did not measure their heights, photographs reveal that Fatoumata was already several centimeters shorter than her sister My field notes from this visit describe them as follows "reddish hair, no tissue in buttocks or thighs, sunken eyes, sunken fontanelles, sores on their faces, vacant stares, can barely crawl " At 19 months, they could not walk or talk They were still nursing and eating only a little food, primarily rice or millet breakfast porridge.

Oumou began to walk when she was 24 months old, and Fatoumata at 26 months At 26 months of age, after intermittent intervention by the author, Fatoumata weighed 7.2 kilos, and Oumou 7.8 kilos. Both of these weights fall between three and four SD below the median. The children were still nursing at this time, and were eating all the adult foods, including rice and millet with various sauces The mother requested that I stop providing formula, because she "didn't have time to give it to them." At the time, I did not understand this statement, but as the study progressed, the truth of her assertion became apparent The twins were weaned at 28 months of age, and their mother reported that they ate more food than before being weaned

The twins were 3 years and 4 months old at the end of the study. They could walk, but not run, could

say only the words for "mother" and "water," and spent their days standing listlessly in the doorway of their house I never measured them again, but a photograph taken at the time, which includes my own daughter, Miranda, aged 3 years and 2 months, shows that they only reach the middle of Miranda's chest, and that Fatoumata, who had been more seriously ill with the measles, was even shorter than Oumou.

What factors contributed to malnutrition in this case? At first, I was inclined to attribute it to their mother's seemingly callous indifference to their welfare. On the scale of "maternal attitude" devised for the larger study (Dettwyler 1985, 1986), she epitomized the "below average" ranking [2] She had asked me to stop bringing formula because it took too much time to give it to the children In addition, she said that the children were a burden to her, that she had little chance of marrying with two small children, and that she would be in a better position for getting out of the compound if they died. As I probed into the motivations underlying these statements, the reality of her position in the family and the conditions of her life became clear

As described earlier, Aminata lived in a compound based around four adult brothers and their elderly mother When Aminata herself was 3 years old, she had been given to her father's sister as a foster child A common practice throughout West Africa, child fostering involves sending young children to live with relatives for a variety of reasons (e g , to provide labor for paternal relatives, to keep an elderly grandmother company in a rural village, or to help a female relative care for a newborn baby) Foster children often have low status in the household, and they may not be accorded the same access to scarce resources as the other children in the family (Bledsoe, Ewbank, and Isiugo-Abanihe 1988; Bledsoe 1991)

After several years, Aminata was passed on again as a foster child, from her aunt to this woman's daughter (her own cousin), who was a young adult at the time This woman, in turn, had married into the family of four brothers, as the second wife of the third brother In this strongly patrilineal, age-conscious society, a man's status in the family depends on his birth order, with the oldest surviving brother being the head of the family Likewise, a woman's status depends both on the status of her husband and on her position as his first, second, third, or fourth wife. Generally speaking, first wives have higher status than later wives. This meant that Aminata was the foster child of the second wife of the third brother in a compound of four adult men Thus, Aminata was the foster child of a woman who also had low status in the household

In addition to her low structural position in a large, patrilineal family, Aminata was several years older than any of the children in the family During 1982 and 1983, she was responsible for the vast majority of the heavy manual labor in the compound, including virtually all of the millet pounding, firewood chopping, water hauling, and clothes washing She also did the majority of the cooking. Even though there were five other adult women in the household, Aminata was never allowed to rest Partly to escape the drudgery of her existence, she used to "go out at night" with a group of boys and girls her own age.

When she was 15 years old, Aminata became pregnant by one of her "friends." The adult men of the compound did not approve of this man, and her life became even worse. The birth of twins, usually viewed as a blessing, was an excessive burden for an unmarried, adolescent girl. Her work load did not change while she was pregnant or after the twins were born, and she was routinely beaten by the women of the compound for her indiscretion in becoming pregnant before marriage. Although the twins' father wanted to marry Aminata, her foster fathers would not allow it.

On a relative scale of socioeconomic status, Aminata's compound would be considered "above average" for the community It contained four adult male wage earners, all of whom were skilled laborers The compound itself was large, with cement-block houses, and the other children of the family were only mildly malnourished, which is typical of children in the community. Therefore, money was available in the family; Aminata, however, had no access to it If she needed money to take her children to the doctor or to buy the food I suggested, she had to ask her cousin, who in turn had to ask her husband These requests were seldom granted. When she had to spend the day at the river washing clothes, she used to leave the children with a friend, because no one at her own compound would watch them for her

She felt that there was little she could do to change her situation or to improve her children's health given her lack of resources She really *didn't* have the time to give them formula or to administer oral rehydration solution every 15 minutes when they were dehydrated from measles or diarrhea Pryer and Crook (1988 19) have noted, "especially during illness when appetite fails, small children need to be fed frequently during the day, which is very time-consuming, and can be especially difficult for mothers from poor families who may have other domestic and economic responsibilities "

Follow-Up In 1989, I returned to Aminata's compound. She was no longer living there, but I was able

to relocate her in a neighboring community According to Aminata, the smaller of the twins, Fatoumata, died in 1984 of malaria Shortly thereafter, Oumou was sent to live with Aminata's own parents (whom she had not seen in many years) in Mopti, a large port town on the Niger River northeast of Bamako. Once both the twins were "out of the way" (her phrase), Aminata's foster family arranged for her to be married to a man of their choosing

Since her marriage in 1984, Aminata has had three more children, of whom two survive. The first child, a boy, is now 4 years old The second, a girl, died in 1986 in Mopti while Aminata was visiting Oumou According to Aminata, this child died from the measles. That was the last time Aminata saw Oumou, and she has no plans to visit her again The third child, another boy, is now one year old The two surviving children have weights and heights that place them in the "mildly malnourished" category

Aminata reports that she is very happy in her marriage and content with her life She married into a large extended family with many adult women to share the work She is the first of two wives of one of the older brothers The women take turns doing the domestic labor, and she only has to work two days each week Looking back on her childhood and adolescence, she says that although she had to work very hard, she learned how to do everything well, so that now her life is comparatively easy She says she tries not to think of Fatoumata and Oumou because it makes her sad She feels no personal responsibility for Fatoumata's death, or for the death of her younger daughter When I asked, "Do you think there is anything you could have done to prevent their deaths," she replied, "You can search for medicine, and give your children medicine, but if it is their time, Allah will take them no matter what you do " Aminata does not admit to any bad feelings toward her foster family, or blame them for contributing to Fatoumata's death or Oumou's separation from her

Fatoumata and Oumou were two of the most severely malnourished children in the study Their malnutrition, like that of Al-Hassane and Assanatu, had many contributing causes If Aminata had not been a foster child, or if she had gotten pregnant by a man her foster fathers liked (so they could have been married), if she had had only one child instead of twins, or if the adult women of the compound had helped more with the household labor—if any one of a number of factors had been different, her children would have been healthier. The combination resulted in an impossible situation As this case clearly illustrates, additional income for the family would not have resulted in any improvement in either her situation or the nutritional status of her children Additional income and nutritional advice for Aminata, personally provided by the researcher, did not help either, as she had neither the time nor the energy to take care of her children.

Case Study III: Children #62, #62a, and #105

Child #105 was a boy named Umaru, and #62 and #62a were Umaru's nephews Mori and Bakari. Umaru is one of the success stories in Farimabougou, while Mori represents one of the more tragic failures. . .

Umaru was his parents' fourteenth child, four of whom had died Umaru contracted polio when he was about 10 months old, and had just recovered from the measles when he entered the study at 18 months of age At that time, his weight of 8 3 kilos placed him in the "moderately malnourished" category (between 2 and 3 SD below the NCHS median for weight-for-age). His mother, Ma, reported that he had lost a lot of weight because of the measles He was weaned at 24 months because his mother was pregnant again

. . , Umaru gained weight fairly steadily over the course of the study, and his last weight of 11 3 kilos at 32 months, while still below the fifth percentile of NCHS standards, placed him in the "mildly malnourished" category typical of children in the community. In the original study, Ma was classified as "above average" in terms of maternal attitude She was very devoted to her children Because of his polio, she regularly took Umaru to the Chinese hospital at Kati, about 15 kilometers distant, for acupuncture treatments and physical therapy, and she spent many hours working with him at home to teach him to walk She was very upset by the death of her first grandchild (#62, below), and distraught by the stillbirth of her own fifteenth child This child, after 10 months of gestation, died during labor and had to be removed by Caesarian section Her doctor warned her that she should not have any more children Even though she had given birth to 15 children, and had 10 still surviving, she was sad that she would not be having more While Ma was recuperating from surgery, her husband took over the cooking, clothes washing, and other domestic chores, actions that are highly atypical for Malian men Umaru's father was devoted to his children and optimistic that Umaru would recover fully from the effects of polio.

Mori (#62) was his mother's first child. His mother, Sali, was Ma's oldest daughter, so Mori was Umaru's nephew At birth, Mori weighed 3 9 kilos, which is above the ninetieth percentile of NCHS standards Mori was weaned at 13 months of age, which is very early for this community, because his mother was

pregnant again When he entered the study at 15 months of age, his weight was 7 9 kilos, placing him in the "moderately malnourished" category

During the next month, Mori came down with the measles and spent 18 days in the hospital in Bamako, where he was fed through a subclavicular IV. At my next visit, when he was 16 months old, he had been home from the hospital for only a few days. His mother reported that, since coming home, he had "refused to eat" and would only drink a little water. During my visits, timed to coincide with meals, she made little effort to encourage him to eat or drink. She was not particularly interested in my suggestions for helping Mori eat, preferring to talk about her current pregnancy.

At 16 months, Mori's weight had dropped to 6.7 kilos At 17 months, it had dropped again, to 6 4 kilos, which is more than four standard deviations below the median. When I came to remeasure him at 18 months, I was told that he had died several weeks before During my last visit, after Mori's death, I witnessed a bitter exchange between Ma and Sali Ma, Mori's grandmother, was sharply critical of her daughter, saying that she was not a good mother, did not care about her children, and was not willing to do what was necessary to keep them alive Sali ignored her mother, replying that she (Sali) was young and did things the "modern" way She blamed Mori's death on the measles and his own refusal to eat She did not see any connection between the fact that Mori had been weaned early because of her subsequent pregnancy and his death from measles/malnutrition, and she felt no responsibility for his lack of food intake after his release from the hospital

The fact that she had weaned Mori very early because of her subsequent pregnancy indicated that she and her husband were not observing the traditional postpartum sex taboo (until the baby is weaned, or at least until he can walk well) Her husband was a recent migrant from a rural village, and the only member of his family to migrate. When I first met them, the young couple was living with her parents, since the husband had no patrilineal relatives in the community Shortly after Mori died, the couple moved out because of "arguments" between mother and daughter and moved in with friends of the father's who lived across town. The grandmother was not informed where they had moved, and they were lost to the study for more than a year

According to Sali's father, his son-in-law was able to "get away" with not observing the traditional taboos, as well as with misguided allocation of scarce household resources, because he had no older agnates to put pressure on him. The fact that he was a recent migrant to the city, and the sole migrant from his family, suggests that he may have been overwhelmed by the opportunities of urban life and was not mature or responsible enough to forego personal pleasure for the health of his children Certainly in a rural village, a young man of his age would not be in charge of his own compound and would not be allowed to make the kinds of choices he made. In addition, in a small rural village, the young couple would not have been able to simply pick up and move away, but would have had to stay under the supervision of elders with more experience. As Gokulanathan and Verghese note, "The gradual break-up of the extended family units under the influence of the wage economy and the movement of people produce changes in the family hierarchy. The authoritative person in the family may be a wage earning member, usually a younger person who may not be sufficiently informed about *either* the traditional ways *or* modern methods (Foster, 1962)" (Gokulanathan and Verghese 1969 123)

. .

In the case of Umaru, we find very different circumstances from those of the other children described in these case studies. Umaru's mother was happily married, an experienced, older mother with 10 healthy surviving children Her first eight children had been born in a rural village, and she was deeply suspicious of urban mores Despite suffering from both polio and measles, Umaru has survived, even flourished Although his family's income was only "average" for the community, and there were many other children to feed (Umaru had seven old siblings still at home), Umaru had exceptional parents. They were devoted to each other and to their children, and did not own any of the symbols of "modern" life such as a moped, a bicycle, or even a radio If primary health care and health education in Mali had been better when Umaru was an infant, he probably would have been vaccinated against measles and polio

By contrast, Sali's maternal attitude was defined as clearly "below average " She was inexperienced as a mother and rejected the traditional values epitomized by her parents Her antagonism toward her mother, and the fact that her mother was recovering from a traumatic Caesarian still birth, made it unlikely that she would or could ask her mother for help or advice Her focus was on her husband and on the acquisition of expensive symbols of modern, urban life, including a moped and multiple sets of fancy clothes In Mori's malnutrition and subsequent death, many factors were at work. If even one had been different, he might have survived. As it was, the combination of inexperienced parents, early weaning, measles, traditional infant feeding practices, and poor maternal (and paternal) attitude were fatal.

CONCLUSIONS

Under certain circumstances, it may be possible to point to one factor as being primarily responsible for malnutrition in a community. Droughts, famines, warfare, and refugee camps garner worldwide attention and represent obvious single-cause reasons for widespread malnutrition in particular instances For example, the relatively high rates of severe malnutrition in northern Mali following the drought of 1984–85 can be attributed to the failure of the rains and the subsequent devastation of animal herds on which the populations relied for subsistence.

Unfortunately for change agents and development agencies (and, of course, for the affected populations), the vast majority of malnutrition in Third World populations does not have one primary cause. Nor does it have a simple solution If alleviating malnutrition were only a matter of increasing household income, providing nutrition education for all mothers, implementing family planning programs, or immunizing all children under five against the major childhood diseases, it would be difficult enough But the widespread chronic mild and moderate malnutrition that affects Third World children under "normal" conditions is the result of an intricate web of interacting factors.

Without the constraint of poverty, Malian women such as Jeneba and Aminata would not have to stay in untenable household situations, and Sali and her husband would not have had to choose between gas for the moped and food for the children Without the constraint of social institutions such as child fosterage, polygyny, patrilineality, and arranged marriages, girls would not find themselves in positions like Aminata's Without traditional infant feeding practices such as weaning as soon as the mother gets pregnant again, and letting children themselves decide whether and how much they want to eat, children like Mori might not die Without the stress of measles, compounded by the high temperatures of the hot season, or the stress of malaria during the rainy season, malnutrition by itself would not be so devastating Without the constraint of inadequate primary health care, measles and malaria themselves would not be so serious a threat Without the constraint of a contaminated environment due to the complete lack of sewage and garbage disposal, children would not get diarrhea so often. Without the constraints imposed by lack of running water and electricity, women would not have to spend hours every day hauling water, chopping firewood, and pounding millet, and would thus have more time and energy to devote to child care activities

Given the conditions of life under which periurban Malian women raise children, it is surprising that the majority of children are *only* mildly malnourished Like the cases described here, in many instances where children are severely malnourished it is because they have fallen through the safety net of overlapping support systems that normally ensure a minimal level of nutrition and health for children in the community. Rather than be chagrined when children fall through the cracks, one must be impressed with the number of children for whom the system works

These three case studies are typical of the histories collected during the original 1982–83 study and the 1989 follow-up study. The details of each child's situation differed, but in every case of severe malnutrition, a variety of biological, social, and cultural factors contributed to the child's poor growth. Conversely, for those children who were growing much better than the average for this population, their household situations included few or none of the constraining factors faced by the women described above

As the case studies presented here reveal, a truly integrated, biocultural approach in nutritional anthropology, including longitudinal case histories of individual children and of populations, is necessary if we are to understand all of the interactions between culture and biology that result in observed patterns of nutritional status, growth and development, morbidity, and mortality, and to use this understanding to design successful intervention programs to improve child health. It may not be possible, or necessary, to specify the exact contribution of each strand to the web, as they will be different for every child It *is* possible to study and describe the web of causation, made up of many different factors that affect child growth and child health To do so, however, requires that researchers begin from a biocultural perspective and have adequate training in both quantitative and qualitative research methodologies, training that enables them to see the faces behind the numbers

Approaches such as "rapid ethnographic assessment" (Bentley, Pelto, and Straus 1988) can provide only a limited understanding of the causes of malnutrition in any particular community Likewise, it is of little value to attempt to reduce the complex causes of malnutrition to one or two easily measurable factors, such as "socioeconomic status," "housing type," or "maternal educational level" In particular, researchers interested in alleviating childhood malnutrition must get beyond simplistic measures of socioeconomic status, and realize that all poor people are not the same—differences in individual and family circumstances have important effects on the health, nutritional status, and survival of children Not all family members have equal access to the household's resources, nor do all parents put children's needs first. Finally, it is misleading, and ultimately futile, to think

that malnutrition can be alleviated by any one "magic bullet" such as oral rehydration solution, Vitamin A enrichment, or breastfeeding promotion campaigns. To save a child from death by diarrhea today using oral rehydration solution, so that he can die tomorrow from malaria, is not a significant improvement. To increase family income, only to have that income spent on costly consumer goods or prestigious but nutritionally inferior "Western" foods, will not improve the nutritional status of children.

Policy planners must acknowledge that malnutrition has no easy solution Programs to improve child health must address many, if not all, of the causes of malnutrition, including the difficult issues of the status of women in patrilineal societies and the disruptive forces of modernization At the same time that multistranded programs to eliminate risk factors are implemented, other programs must be designed that strengthen the various strands of the safety net already operating in every community to ensure that more children survive and prosper

NOTES

1 Birth certificates are filled out at the maternity clinic at the time of birth If a child is not born at the clinic, he or she must be taken to the clinic within three days to register the birth Therefore, the birth certificates are assumed to be accurate Parents occasionally forge a birth certificate to enable a child to begin school before the official age of 8 years, but this practice did not affect the young children involved in this sample

2 The "maternal attitude" scale divides mothers into three categories of "average," "above average," and "below average " A mother with an "above average" maternal attitude is one who always makes sure her child is awake and present at meals, fixes foods that the child especially likes, buys him extra food on a regular basis, takes him to the doctor when he is sick, and purchases the prescribed medications A mother with a "below average" maternal attitude is one who lets her child sleep or play through meals, does not cater to his food preferences or buy him extra food, and is less likely to consult medical personnel when he is sick, spend money for prescribed medicines, or administer medications consistently

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