Infant growth patterns in the slums of Dhaka in relation to birth weight, intrauterine growth retardation, and prematurity[1–3]

Shams E Arifeen, Robert E Black, Laura E Caulfield, Gretchen Antelman, Abdullah H Baqui, Quamrun Nahar, Shamsuddin Alamgir, and Hasan Mahmud

ABSTRACT

Background: Relations between size and maturity at birth and infant growth have been studied inadequately in Bangladesh, where the incidence of low birth weight is high and most infants are breast-fed.
Objective: This study was conducted to describe infant growth patterns and their relations to birth weight, intrauterine growth retardation, and prematurity.
Design: A total of 1654 infants born in selected low-socioeconomic areas of Dhaka, Bangladesh, were enrolled at birth. Weight and length were measured at birth and at 1, 3, 6, 9, and 12 mo of age.
Results: The infants' mean birth weight was 2516 g, with 46.4% weighing <2500 g; 70% were small for gestational age (SGA) and 17% were premature. Among the SGA infants, 63% had adequate ponderal indexes. The mean weight of the study infants closely tracked the −2 SD curve of the World Health Organization pooled breast-fed sample. Weight differences by birth weight, SGA, or preterm categories were retained throughout infancy. Mean z scores based on the pooled breast-fed sample were −2.38, −1.72, and −2.34 at birth, 3 mo, and 12 mo. Correlation analysis showed greater plasticity of growth in the first 3 mo of life than later in the first year.
Conclusions: Infant growth rates were similar to those observed among breast-fed infants in developed countries. Most study infants experienced chronic intrauterine undernourishment. Catch-up growth was limited and weight at 12 mo was largely a function of weight at birth. Improvement of birth weight is likely to lead to significant gains in infant nutritional status in this population, although interventions in the first 3 mo are also likely to be beneficial.   *Am J Clin Nutr* 2000;72:1010–7.

KEY WORDS   Infant nutrition, growth, birth weight, fetal growth retardation, gestational age, Bangladesh

INTRODUCTION

Gestational age and nutritional status at birth are important determinants of growth patterns in infancy (1–12). The incidence of low birth weight in Bangladesh, predominantly the result of intrauterine growth retardation, is among the highest in the world (13–16). To formulate appropriate policy recommendations on breast-feeding and complementary feeding, a full understanding of the relation between nutritional status at birth and growth during infancy is necessary.

The growth of children in many developing countries, including Bangladesh, appears to falter at 3–4 mo of age in comparison with the National Center for Health Statistics (NCHS) reference population (17–22). This faltering was traditionally thought to reflect the effects of dietary insufficiency and the onset of infectious disease morbidity in this age group. It was noted, however, that breast-fed infants in some developing countries and those in more affluent settings have similar growth patterns in infancy (21, 23–25). If this finding is confirmed in extremely poor populations such as found in Bangladesh—a country in which most infants are breast-fed, there is a high incidence of low birth weight, diets are limited for lactating women and infants, and infectious diseases are common—there are important implications for feeding recommendations in early infancy, especially regarding the duration of exclusive breast-feeding.

This study of a cohort of newborns was conducted in a sample of the urban slum population of Dhaka, Bangladesh. By assessing the newborns' gestational ages and birth weights and weights and lengths throughout infancy, we were able to assess overall growth patterns in comparison with reference populations and growth patterns in subgroups defined by size and maturity at birth.

SUBJECTS AND METHODS

Study population and sample

Residents of low socioeconomic status of 5 districts (*thana*) of Dhaka City constituted the study population. The International

Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) maintained a demographic and health surveillance system in a sample of these areas. Pregnancy surveillance was conducted to identify all eligible pregnancies and all births to women living in these areas and in additional clusters selected for this study. From November 1993 until June 1995, a total of 1654 singleton newborns first visited within 13 d of birth were enrolled in the study.

Data collection

Information on socioeconomic and demographic characteristics of the household and the date of the mother's last menstrual period was obtained through the pregnancy surveillance system. Each infant's weight and length were measured at the enrollment visit by trained fieldworkers. Trained physicians conducted a postnatal physical examination to assess gestational age by use of the Capurro method (26), which is a modified and simplified version of the more well-known Dubowitz method (27). The Capurro method uses only 5 somatic signs and an optional neurologic sign (which was not used in this study). The gestational age of most newborns was based on the date of the mother's last menstrual period. However, for 246 newborns (15%) of mothers with missing or implausible data concerning the last menstrual period, the results of the physical examination were used to estimate gestational age. Newborns with gestational ages <37 completed weeks were classified as preterm.

Infants were revisited at 1, 3, 6, 9, and 12 mo of age for subsequent weight and length measurements. Infant weights were measured by using either beam scales or electronic scales (SECA, Hamburg, Germany). Although all weight measurements were expected to be made with the beam scales, which are accurate to 10 g, an increasing proportion of the weights from the 6-mo visits onward were measured with electronic scales accurate to 100 g for ease of field logistics. Agreement in weight measures between the 2 types of scales was assessed in a subsample of infants ($n = 100$); the correlation between the measures was 0.99 and there was no evidence of systematic differences. Supine lengths were measured to the nearest millimeter with locally manufactured wooden length-measuring boards according to recommended procedures. All data collectors received an initial 3 d of training in infant anthropometry. Data collectors were retrained several times during the course of the study and observer errors were assessed and corrected. The reliability of the anthropometric measurements was high (reliability coefficient = 99.99%) (28). All scales were adjusted daily in the field offices with use of standard weights and on randomly selected days immediately before anthropometric measurements were made in the subjects' homes.

Because births occurred at home in this population, infants' weights at birth were not available. In a subsample of infants ($n = 99$), we measured weights daily for 14 d after birth. We observed no change in weight in the first 72 h in this subsample, as was reported for other small-for-gestational-age (SGA) populations (29). Therefore, weights measured within 72 h of birth (74% of the sample) were used as birth weights for the purpose of assessing the adequacy of fetal growth. We developed the following regression equation from the subsample data based on random effects models (random intercepts and slopes):

$$\hat{y} = 2565.982 - 58.399 \times age + 35.092 \times age^2 - 4.114 \times age^3 + 4.184 \times [(age - 3)^+]^3 \tag{1}$$

The equation was used to estimate birth weights when enrollment weights were measured 3–13 d after delivery. The estimated birth weights were used to classify infants into body weight and intrauterine growth retardation categories. However, the actual weights and lengths at enrollment and at the 5 followup visits were used in the analysis of growth. Newborns were defined as low birth weight if their estimated birth weight was <2500 g. The infants were also classified as either SGA or appropriate-for-gestational-age (AGA) by using the 10th percentile as the cutoff on a gestational-age-specific and sex-specific birth weight chart based on a US reference population (30). SGA newborns were classified as having an adequate ponderal index [PI = weight (in g)/length (in cm)^3], representing symmetric growth retardation in both weight and length, or a low PI, representing asymmetric growth retardation, ie, infants more retarded in weight than in length (31). An infant was classified as having a low PI if the index was less than the 10th percentile on a reference chart of PI for each gestational age category (32).

The study was approved by the Ethical Review Committee of the ICDDR,B and the Committee on Human Research of the Johns Hopkins University School of Hygiene and Public Health. All data were collected after informed, verbal consent was obtained from at least one parent or caretaker.

Statistics

All descriptive statistics at enrollment are based on the entire sample of 1654 infants whose birth weight was measured within 72 h of delivery or was estimated from a measurement of weight taken >3 d postpartum. Body weights and lengths at different ages were compared with the US NCHS reference growth curves and with growth curves based on a pooled sample of breast-fed infants from developed countries produced by the World Health Organization Working Group on Infant Growth (23). When necessary, the weighted averages of the weights and lengths of the reference boys and girls based on the sex distribution of the study sample were used.

Repeated-measures analysis of variance (ANOVA) was used to assess interactions between age and classification variables of size and maturity at birth. Monthly weight increments were calculated by dividing the change in weight for each child by the chronologic increase in age. This analysis was limited to a subsample of 614 infants for whom all 6 weight measurements were made within ±15 d of the scheduled ages. This allowed us to compare weight gain at different ages in the same cohort of infants and also to compare the data with data from the pooled breast-fed sample. Correlation between subsequent weights was estimated by using residuals from a multiple linear regression model of weight at different ages. Residuals were used in this analysis rather than actual weights because we were interested in the correlation between repeated measures, which was not the consequence of other individual, maternal, or household characteristics included as covariates in the model. All analyses were performed with SAS software for WINDOWS (version 6.12; SAS Institute, Cary, NC).

RESULTS

General and baseline characteristics of the sample

Nearly three-quarters of the 1654 newborns were enrolled within 72 h of birth. Slightly more than half of the enrolled newborns were boys. The average age of the mothers of the newborns was 25 y. Almost three-quarters of the mothers had no formal education, 95% were Muslims, a little more than two-thirds were
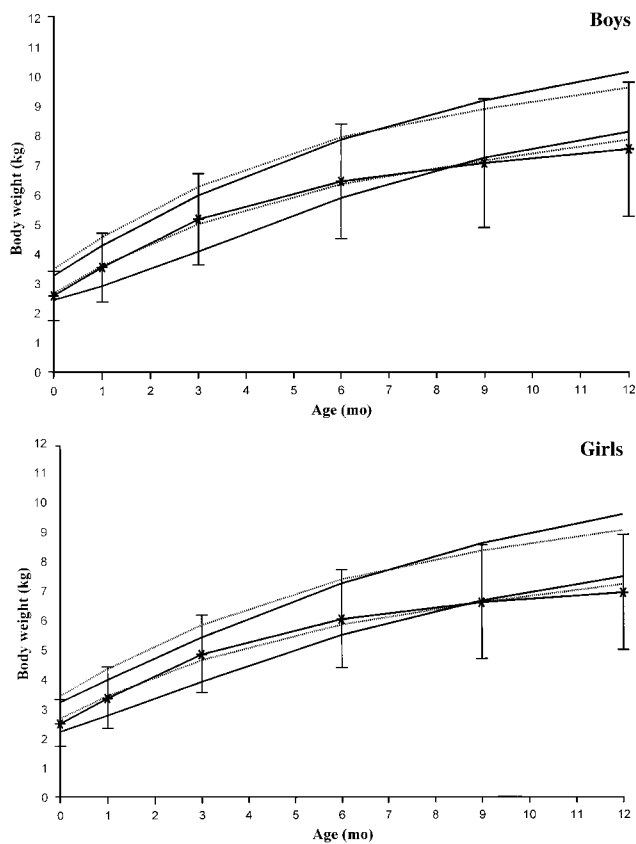
FIGURE 1. Mean (±2 SD) body weight by age. The solid line with an asterisk indicates the mean weight of the study infants, the other solid lines are the National Center for Health Statistics reference median and −2 SD, and the dashed lines are the pooled breast-fed sample mean and −2 SD (23).

born outside Dhaka, and 62% were shorter than 150 cm. The index infant was the first birth for 26% of mothers and the second birth for 23% of mothers. Thirty-one percent of the mothers had a history of previous child death. Sixty percent of the fathers had no education. The mean monthly household income of the sample was ≈US$75 and nearly 40% of the households had no major possessions (eg, television, radio, bicycle, rickshaw, cupboard, table, watch, or clock).

The newborns' mean (±SD) birth weight was 2516 ± 404 g. Slightly fewer than half of the newborns (46.4%) had low birth weights (<2500 g) and 9.6% weighed <2000 g at birth. The mean (±SD) length of the newborns was 47.7 ± 2.3 cm at enrollment. Preterm births constituted 16.8% of the sample. More than two-thirds (69.6%) of the newborns were determined to be SGA. Only 17.3% of the newborns were born full-term and AGA, 13.1% were preterm AGA, and 65.9% were term SGA. A very small proportion of the infants were both preterm and SGA (3.7%). Of 1152 SGA births, 63% had an adequate PI and 37% had a low PI.

Among the enrolled infants, 9.5% (*n* = 157) died during follow-up and another 14% (*n* = 235) were lost to follow-up as a result of emigration. Apart from these missing observations, information was also missing for some infants at each visit because of temporary absence, refusal, and other reasons. Infor-

mation on weight, length, and other variables at 12 mo was available for 73% of the total sample (*n* = 1207).

Those who emigrated differed from the remaining infants with respect to the mother's age, height, parity, place of birth, and household possession of assets (33). The emigrated women were significantly more likely to be younger, taller, primiparous, and born outside Dhaka than were the mothers who remained in the study area. The households lost to follow-up also had fewer assets and were thus likely to be poorer. The relation with income was in the same direction. The prevalence of low birth weight, intrauterine growth retardation, and prematurity was similar between those who emigrated and those who remained in the study area.

Body weight at follow-up visits and nutritional status at birth

In **Figure 1**, the mean attained body weight of the infants in the study sample is compared with NCHS reference growth curves and with growth curves from the pooled sample of breast-fed infants. Only infants for whom weight and length were measured within ±15 d of scheduled visits were included. From birth to 3 mo of age, the mean weight of both male and female infants paralleled the NCHS median at a lower level. After this age, the mean weight diverged from the NCHS reference curve. In contrast, the growth of the Dhaka infants was similar to the curves for the pooled breast-fed sample. Mean weight closely followed the −2 SD curve of the pooled breast-fed sample throughout infancy, with a slight reduction apparent only after 8 mo. For both references and in both sexes, the average weights of the Bangladeshi infants dropped below the −2 SD reference curves just before 9 mo. The pattern was similar for length (**Figure 2**).

Growth status during infancy appeared to be strongly related to size at birth. Shown in **Figure 3** are the mean weights of infants by age for each 500-g birth weight category. The 4 curves closely parallel each other throughout infancy, and at each time point in which weight was measured, the difference in means between the 4 groups of infants remained fairly constant. Classification by weight and gestational age at birth also predicted attained weight during infancy (**Figure 4**). There was little difference between preterm AGA infants and full-term SGA infants, whereas the mean weight of preterm SGA infants remained much lower than that of the other groups. The mean growth curves of the SGA infants with adequate and low PIs paralleled each other, although the adequate-PI SGA infants weighed 193 g more at birth and 163 g more at 12 mo; the mean difference between the AGA and SGA infants remained fairly constant during infancy (**Figure 5**). Repeated-measures ANOVA based on a subsample of 614 infants in whom all 6 measurements were made within ±15 d of scheduled dates showed no significant interaction between age of the child and the birth size and maturity variables used in Figures 3–5.

An apparently similar pattern of parallel growth curves was observed with length of the study infants (**Figures 6** and **7**). However, repeated-measures ANOVA (*n* = 608) indicated significant (*P* < 0.01) interactions between age and birth weight (4-level categorical variable) and between age and intrauterine growth retardation type (AGA, adequate-PI SGA, and low-PI SGA). On a closer examination of the mean lengths, the difference between the heavier and lighter infants, and between the AGA and low-PI SGA infants, appeared to narrow as the infants aged.

The patterns and levels of growth were similar to those in the pooled breast-fed sample (Figures 3–7). The infants with normal birth weights and the full-term AGA infants remained above the
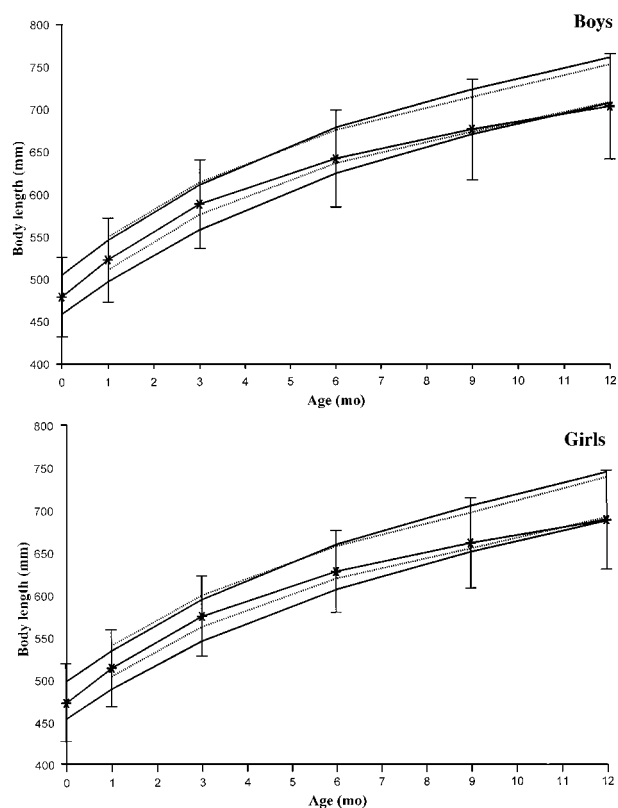
FIGURE 2. Mean (±2 SD) body length by age. The solid line with an asterisk indicates the mean weight of the study infants, the other solid lines are the National Center for Health Statistics reference median and −2 SD, and the dashed lines are the pooled breast-fed sample mean and −2 SD (23). Length data at birth were not available for the pooled sample.

−2 SD of the pooled breast-fed growth curve almost throughout infancy. The mean weight of the full-term AGA infants was slightly >3 kg at birth (≈1.0 SD below the pooled sample mean) and increased to just <8 kg at 12 mo (≈1.7 SD below the pooled sample mean). Interestingly, the mean weight of even the heaviest infants in our sample (≥3000 g; *n* = 167) was below the reference mean at birth and increasingly lagged behind the reference mean after the first few months (Figure 3).

The mean monthly weight increments at different ages in the subsample of 614 infants are shown in **Table 1**. The data do not show postnatal catch-up growth among the lighter infants. On the contrary, there was some indication that the heavier infants (normal birth weight, term, and AGA) grew faster in early infancy, with normal-birth-weight infants gaining 73 g more than the low-birth-weight infants during the first 3 mo. On average, the weight gain was ≈0.4 SD less than that in the breast-fed sample in the first 3 mo of life and ≈1 SD less in the later half of infancy.

In **Figure 8** the mean attained body weight and length at different ages during infancy is compared with the NCHS reference population and the pooled breast-fed sample. Comparison of the Dhaka infants with the 2 references produced different interpretations. Overall, the study infants appeared to be more underweight and stunted compared with the breast-fed reference than compared with the NCHS population before 9 mo. From birth to
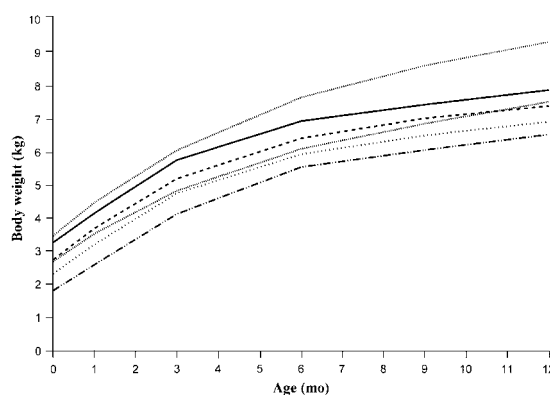

FIGURE 3. Mean body weight by age and birth weight. ———, ≥3000 g; ‑ ‑ ‑ ‑ ‑, 2500–2999 g; • • • • • •, 2000–2499 g; — ‑ —, <2000 g; — ‑ —, mean and −2 SD of the pooled breast-fed sample (23).

3 mo, the study infants showed substantial improvement in weight, and to a lesser extent, in length relative to both references. From 3 mo, the growth rate of the Dhaka infants appeared to fall steeply compared with the NCHS reference, whereas the faltering was much more gradual compared with the breast-fed reference. At 12 mo, the mean weight-for-age *z* score compared with the breast-fed sample was almost the same as at birth, whereas the *z* score compared with NCHS reference was 1 SD lower than at birth. In contrast, length-for-age *z* scores were similar for both references at 12 mo and were considerably lower than *z* scores at birth.

The correlation matrix of the residuals from a multiple regression analysis is presented in **Table 2**. The residuals were grouped by rounding age at measurement to the nearest month (within ±15 d). The matrix includes only measures taken at the originally scheduled times, ie, 0, 1, 3, 6, 9, and 12 mo. Two distinct patterns were apparent before and after 3 mo. Residuals at ages
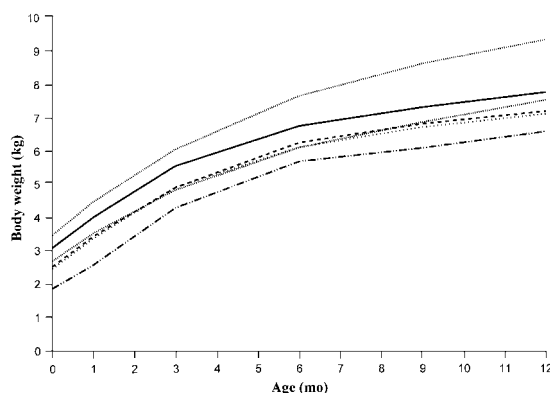

FIGURE 4. Mean body weight by age, gestational age, and intrauterine growth retardation status. ———, term appropriate-for-gestational age (AGA); ‑ ‑ ‑ ‑ ‑, preterm AGA; • • • • • •, term small-for-gestational-age (SGA); — ‑ —, preterm SGA; •••••••, mean and −2 SD of the pooled breast-fed sample (23).
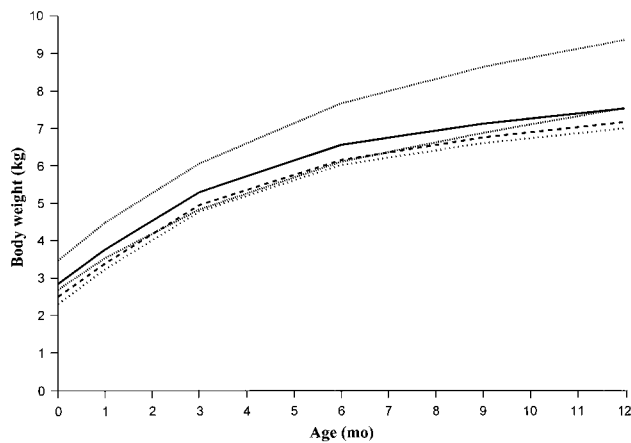
FIGURE 5. Mean body weight by age and intrauterine growth retardation type. ━━━━, appropriate for gestational age; ▬ ▬ ▬ ▬, small for gestation age (SGA), low ponderal index (PI); • • • • • • • , SGA, adequate PI; •••••••, mean and −2 SD of the pooled breast-fed sample (23).

FIGURE 6. Mean body length by age and birth weight. ━━━━, ≥3000 g; ▬ ▬ ▬ ▬, 2500–2999 g; • • • • • • • , 2000–2499 g; ▬ ▪ ▬, <2000 g; •••••••, mean and −2 SD of the pooled breast-fed sample (23).

0 and 1 mo were highly correlated with the immediate next weight but the correlation rapidly became less strong as the interval between measurements increased. The correlations of residuals at consecutive ages were stronger with increasing age and became stationary after 3 mo, eg, correlations between measures 3 mo apart were the same irrespective of age.

DISCUSSION

There was a close concordance between the average pattern of growth in the study population and that in the pooled breast-fed sample (23). Several authors have suggested that monthly incremental weight gain is a more sensitive indicator of growth faltering than attained status and have proposed the use of a cutoff of 2 SDs below the mean monthly weight gain in a reference population to indicate growth faltering (19, 34, 35). When compared with the World Health Organization breast-fed sample, the average monthly weight gain of the study infants hovered around 1 SD below the mean. Therefore, in any 1-mo period, the average infant did not meet the proposed criterion for growth faltering.

In several previous studies from developing countries, growth faltering was identified at 6 mo when a breast-fed reference was used but at 3 mo when the NCHS reference was used (21, 23). Compared with both the NCHS reference and the pooled breast-fed sample, our study sample showed obvious catch-up growth in the first 3 mo, but this was followed by faltering from 3 mo onward. This was obvious when the study infants were compared with the NCHS reference, but was much more gradual relative to the pooled breast-fed sample. The mean *z* score based on the pooled breast-fed sample for the study infants at 12 mo was the same as at birth. The incremental weight data also suggested limited faltering. The observed improvement in nutritional status in the first 3 mo and the reversal thereafter suggests that there was some potential for postnatal catch-up growth, which was probably limited by diet and morbidity in the latter part of infancy. However, it seems likely that the high prevalence of undernourishment seen in these Bangladeshi infants was only partially due to postnatal influences on growth during later infancy and that
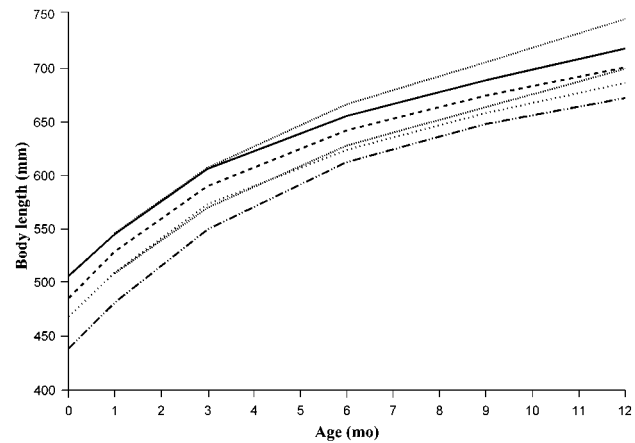
smaller size at birth also played an important role in the suboptimal growth patterns of these infants.

One caveat regarding this interpretation of the data should be mentioned. The NCHS reference and the pooled breast-fed sample differ not only in terms of their means, but also in their variability, which is lower in the breast-fed sample. This partially explains the low level, but not the pattern, of the curves based on the breast-fed sample. If we were to apply the larger NCHS SD estimates to the pooled breast-fed sample, the mean weight-for-age and length-for-age curves of the Bangladeshi infants based on the pooled breast-fed sample mean would be shifted upward and the faltering would be even less apparent, especially given that these curves are flatter than the NCHS-based curves.

A few births were not enrolled because of delayed reporting of the birth, ie, >13 d after birth. The likely effect of nonenrollment for this reason on the observed prevalence estimates would be minimal given the small number of infants involved. Infants
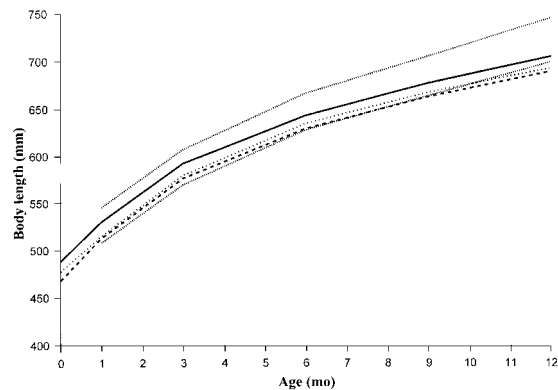

FIGURE 7. Mean body length by age and intrauterine growth retardation type. ━━━━, appropriate for gestational age; ▬ ▬ ▬ ▬, small for gestational age (SGA), low ponderal index (PI); • • • • • • • , SGA, adequate PI; •••••••, mean and −2 SD of the pooled breast-fed sample (23).

TABLE 1
Mean monthly increment in body weight by age and status at birth[1]

Characteristics	Age interval (mo)				
	0–1	1–3	3–6	6–9	9–12
			g		
Estimated birth weight					
NBW (≥2500 g) (*n* = 345)	991[2]	754	405[2]	211	130
LBW (<2500 g) (*n* = 269)	945	740	430	188	125
Gestational age					
Term (only AGA) (*n* = 108)	998	766[2]	416	202	115
Preterm (only AGA) (*n* = 79)	995	710	462	189	123
IUGR					
AGA (term + preterm) (*n* = 187)	997	742	436[2]	196	118
SGA (term + preterm) (*n* = 427)	960	751	408	203	133
AGA (*n* = 187)	997[2]	742	436[2]	196	118
SGA, low PI (*n* = 150)	982	751	413	197	137
SGA, adequate PI (*n* = 277)	947	751	405	207	130
Overall (*n* = 614)	971	748	416	201	128
Mean *z* score[3]	NA	−0.4	−0.7	−1.1	−1.0

[1] NBW, normal birth weight; LBW, low birth weight; AGA, appropriate for gestational age; SGA, small for gestational age; IUGR, intrauterine growth retardation; PI, ponderal index; NA, not available.

[2] $P < 0.10$.

[3] Mean *z* score based on the distribution of weight increments of a pooled sample of breast-fed infants (23).

who completed or dropped out did not differ with respect to prevalence of low birth weight, intrauterine growth retardation, and prematurity. Compared with those who completed follow-up, the mothers of the infants lost to follow-up were younger, primiparous, taller, poorer, and more likely to be born outside Dhaka. In a regression analysis using observed weights (data not shown), these factors were found to be associated with infant growth, although the effect on infant weight was not in the same direction for all the factors and was sometimes different in the 2 halves of infancy or limited to only one-half of infancy. This makes it difficult to estimate whether the growth of those who dropped out would have been different, but we believe that such a difference would have been small.

The results of the present study support the argument for the development of a new reference for infant growth based on a population that follows current recommendations for infant feeding, particularly continued breast-feeding until 1 y and exclusive breast-feeding to ≈4–6 mo. About 27% of the study infants were exclusively breast-fed at 3 mo of age and another 14% were predominantly breast-fed. This proportion is much lower than that in the pooled breast-fed sample, in which infants were included only if they were predominantly breast-fed (including exclusive) for ≥4 mo. On the other hand, the proportion of the study infants receiving breast milk at 12 mo of age was similar to that in the pooled sample, in which all infants continued to be breast-fed until their first birthdays. We expect, however, that the quality of complementary foods in the latter half of infancy was poor in our sample. The growth curves based on the NCHS reference population are known to underestimate growth in the first 3 mo and overestimate it after 3 mo (23), which also appears to be the case here. The similarity of the growth of breast-fed infants across populations and the difference from the NCHS reference was also shown in recent analyses of data from different populations (36).

The results of this analysis suggest that apart from postnatal age, birth weight may be the most important determinant of subsequent growth status during infancy in this population. Studies
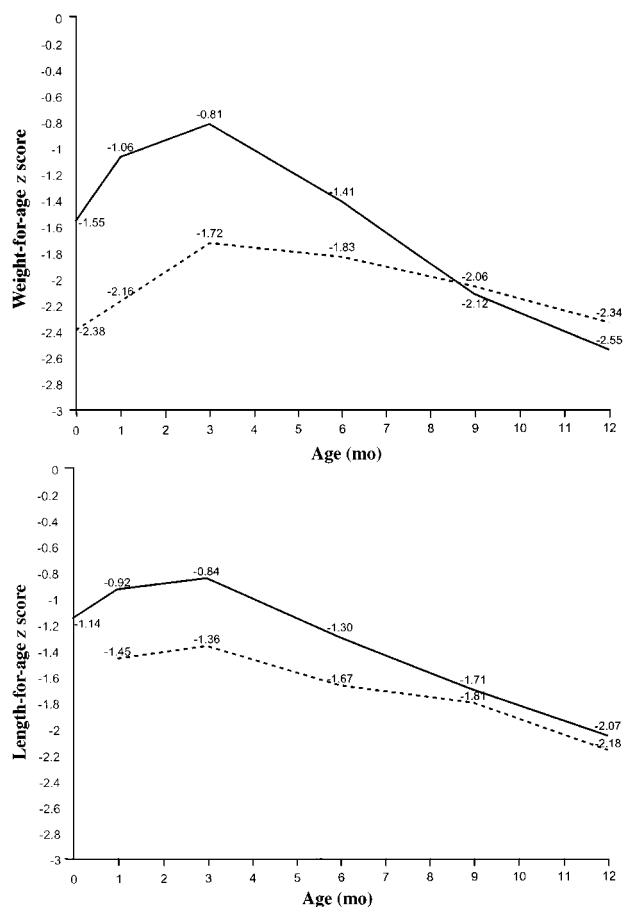

FIGURE 8. Mean *z* scores by age and reference population. ———, *z* score by National Center for Health Statistics reference; – – – –, *z* score by pooled breast-fed sample (23).

TABLE 2
Correlation matrix of residuals of ordinary least-squares (fixed-effects) model of weight as the response variable[1]

Age (mo)	Age (mo)				
	1	3	6	9	12
0	0.699	0.363	0.183	0.118	0.073
1		0.677	0.429	0.377	0.292
3			0.757	0.678	0.571
6				0.777	0.687
9					0.747

[1]Covariates in the model were as follows: infant's age and sex, intrauterine growth retardation and gestational age status, breast-feeding status in the first 4 mo of life, and complementary foods and drinks; mother's age, education, height, place of birth, parity, and history of previous child death; 2-wk prevalences of diarrhea and acute respiratory infection; and household income.

in widely different populations have also shown the same phenomenon of "growth channels" determined at birth (6, 37–39). Average differences in weights between infants classified by gestational age and AGA or SGA status were also similar at birth and 12 mo. Because we did not correct for the age of preterm infants, we expected the preterm infants, especially those who were AGA, to exhibit some catch-up growth. However, unlike in several studies from developed countries (2, 3), the preterm infants in Dhaka slums grew at about the same rate as did those born at term. The low-PI SGA infants in our study also did not show any catch-up growth, in contrast with findings in other populations (7).

The study is consistent with other studies in Bangladesh showing a high prevalence of low birth weight (13, 14, 40, 41). As expected, many of the low birth weights in this sample were due to intrauterine growth retardation; more than two-thirds of the newborns were growth retarded, one of the highest percentages in the world. The high proportion of SGA infants with adequate PI in this population points to the influence on intrauterine growth of factors operative in early pregnancy or before.

The nearly universal poor nutritional status found in this population of infants whose birth weight distribution was shifted to the left provides strong justification for focusing greater attention on improving birth weights as an important intervention aimed at reducing undernutrition in infancy and perhaps in later childhood. The potential that the Dhaka infants showed toward catching up to the reference means in the first 3 mo of life and the greater plasticity of growth during this period also suggest that these infants may respond to targeted postnatal interventions during the first 3 mo. Interventions aimed at reducing the apparent decline in growth rates from 6 mo onward should also be considered, although the stationary and high correlation between successive weights during this period may indicate greater inflexibility and lower likelihood of success.

The first quarter of infancy provides a window of opportunity during which interventions aimed at improving a child's growth channel may be successful. This finding is in contrast with the findings of some studies in Latin America, in which the later part of infancy was identified as the most effective time for intervention (42, 43). Interventions in early infancy would involve promotion of exclusive breast-feeding, particularly aimed at improving the frequency and intensity of breast-feeding, and improved feeding of undernourished mothers to increase lactation performance (44). The potential of micronutrient supplementation to accelerate growth in the first 3 mo also needs to be investigated. Increased attention to the first 3 mo, however, need not be at the expense of promoting appropriate complementary feeding in later infancy; we found evidence of growth faltering after 3 mo of age, when diet may be the limiting factor.

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