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Senegal

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Objective: To describe infant feeding practices in rural Senegal in relation to age and nutritional status. The main hypothesis to be tested was whether mothers modulate feeding in response to growth and nutritional status of their infants.
Design: A cross-sectional survey using qualitative 24-h recalls and lifetime recalls to assess feeding practices, and using weight and recumbent length measurements to assess nutritional status.
Setting: Three health clinics in the Fatick region, a rural area of Senegal, West Africa, covering a population of 26 600.
Subjects: All 2–10-month-old infants attending four immunization sessions in 1991 (n = 1174; 80% of convoked infants).
Main outcome measures: Prevalence of feeding with additional food (gruel, family diet and food of animal origin), weight-for-length and length-for-age.
Results: All infants were breastfed. A supplement had been given the day before the survey to 10% of infants aged 2–3.9 months, 30% of infants aged 4–5.9 months and 45% of those aged 6–6.9 months. The main food items were watery millet gruel and family diet (millet or rice). Gruel was given in response to perceived breast-milk insufficiency. Animal products were seldom eaten at any age. Length-for-age and weight-for-length were significantly lower among infants supplemented with millet gruel, when adjusted for age; while no such relationship was found with family diet.
Conclusion: Mothers preferentially fed gruel to small, thin infants.
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Descriptors: Africa, feeding practices, growth, infant, rural, weaning food

Introduction

Protein energy malnutrition remains highly prevalent among preschool children in less developed countries. According to the WHO, 30–40% of all children under 5 years of age are malnourished (UNSN, 1988). Among these, 80% suffer from linear growth retardation, also called stunting or chronic malnutrition, while the remaining 20% suffer from wasting, also termed acute malnutrition (Waterlow, 1972).

Although infants usually have a rather good nutritional status compared to children over the age of 1 year, stunting is initiated during infancy (Waterlow, Ashworth & Griffiths, 1980; Waterlow, 1988). During the last few years,

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increasing evidence has confirmed that in developing countries the height status of a child until the age of 5 years is largely determined by the age of 1 year (Forman *et al.*, 1990; Huttly *et al.*, 1991; Simondon *et al.*, 1991). The importance of infancy in the development of wasting has been less well documented, but retrospective studies have indicated that children who were moderately wasted at age 18 months, already had significantly lower body mass index than other children by the age of 3 months (Simondon, 1991). Any attempt to prevent childhood malnutrition would therefore need to carefully consider the infancy period.

Infant feeding is obviously a determining factor in growth and nutritional status and is considered to be more important than morbidity (Briend *et al.*, 1989; Briend, 1990). Prevention of childhood malnutrition should therefore include the nutritional education of mothers, but any such programme must be based on careful study of current practices in the community.

Here we present results of a qualitative study conducted in the Niakhar study area in Senegal in 1991 on the food consumption patterns of infants aged 2–10 months. The aims of the study were to describe food consumption patterns according to age and to relate these patterns to the nutritional status of the children.

Subjects and methods

The Niakhar study area, located in Central Senegal in the Peanut Basin about 150 km from the capital city of Dakar, has been under continuous demographic surveillance since 1987. The 26 600 inhabitants are Serere farmers cultivating groundnuts and millet. The year is composed of three main seasons: a cold, dry season from November to December to February, a warm, dry season from March to June, and a warm rainy season from July to October. The majority of adults, and especially women, have had no schooling (78% of women in the age group 15–24 years and 90% in the age group 25–34 years; Projet Niakhar, 1992; for a detailed description of the area, see Simondon *et al.*, 1993). The diet of adults and older children is composed of steamed millet and rice, small amounts of fish either fresh or dried, and sauces made from leaves, chili, peanuts, etc. (Chevassus-Agnes & Ndiaye, 1981). The local weaning food is a rather liquid millet gruel made from millet flour cooked in water. Sugar and sometimes salt are added to improve taste. Energy density is low. Animal milk given to infants is obtained locally from either cows or goats and is usually given sour. Purchased powdered milk is seldom consumed.

This study was conducted during the immunization sessions in May, July, September and December, 1991 by means of interviews with the infants' mothers. Immunization sessions were conducted monthly in each of the three dispensaries in the area. Families were informed about the coming session at their homes one week ahead of time and absent infants were visited at home during the sessions and again invited to attend. The resulting coverage rate was about 80%. Infants were called in at ages 2, 4, 6 and 9 months, but many were brought in the following month, so the age span of 2–10 months was covered. All invited infants who presented at the immunization sessions were included. Uncalled children were not included, since they often came because of illness and their inclusion would have biased feeding patterns. A total of 1181 infants were included in the study. Seven were excluded from the analysis due to inconsistent weight or length records; results are thus given for 1174 infants, 582 boys and 592 girls.

The interviews were divided into two parts. Mothers were first asked to describe the food they had given to their child the day before the survey, meal by meal. The consumption of breast milk and water was noted, but quantification of food intake and frequency of breastfeeding could not be obtained from interviews. In the second part of the interview, mothers were asked whether the child had already eaten each of a list of foods usually consumed in the study area, and if yes, at which age it had been given for the first time. Only true consumption was noted, since, in this area, foods are first introduced to infants in very small amounts left in the mouth to accustom them to the taste.

Anthropometric measurements were performed using standardized methods. Children were weighed naked on a SECA scale and weight was recorded to the nearest 10 g. Recumbent length was measured using a locally made wooden board and length was recorded to the nearest mm. Exact date of birth was known

for all infants due to weekly visits to all compounds by demographic field workers.

For analysis, the rates of children with different types of feeding patterns were calculated for monthly age intervals (2.0 to 2.9, 3.0 to 3.9, etc.). Nutritional status was expressed in anthropometric indices, weight-for-length and length-for-age (Waterlow *et al.*, 1977). Weight-for-length and length-for-age indices were calculated using Anthro V. 1.01 (CDC/WHO, 1990) and expressed in Z-scores of the NCHS reference. Statistical analyses included one- and two-way analysis of variance and χ^2-test. Partial comparisons were done using *t*-tests with correction of the significance level (Bonferroni's inequality). The study was conducted with authorization from national health authorities, but specific ethical approval could not be obtained since no ethical review committee existed in Senegal at the time of the study.

Results

Age and sex distributions of the study population are given in Table 1. All monthly age groups were well represented except for the 8.0–8.9-month group (n = 22).

Feeding practices are described according to age of the infants. All infants were breastfed at the time of the study and all were given water in addition to breast milk. The ratio of infants who had consumed either specific weaning food (millet gruel), animal milk or family diet (food from the common dish) the day before the survey is shown in Fig. 1. Specific weaning food was given to <20% of infants. The proportion of infants given gruel the day before

Table 1 Age and sex distribution of the study sample

Age (months)	*Boys*	*Girls*	*Total*	*%*
2–2.9	106	117	223	19.0
3–3.9	45	46	91	7.8
4–4.9	89	97	186	15.8
5–5.9	49	54	103	8.8
6–6.9	88	81	169	14.4
7–7.9	72	63	135	11.5
8–8.9	15	7	22	1.9
9–9.9	88	86	174	14.8
10–10.5	30	41	71	6.0
Total	582	592	1174	100

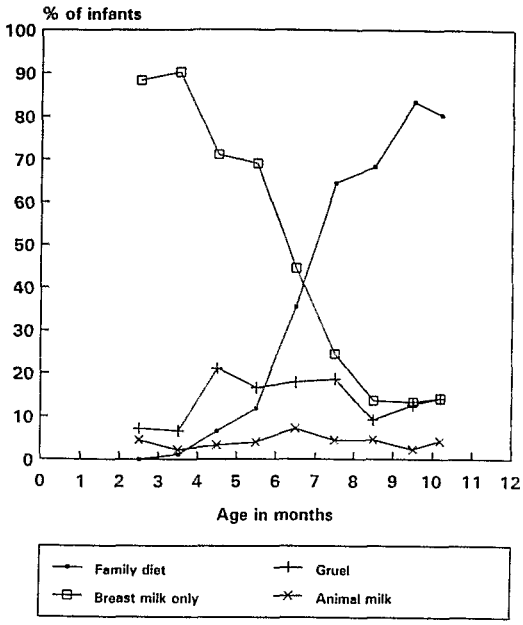

Fig. 1. Proportion of children who had eaten millet gruel, family diet, sour milk or only breast milk the day before the survey.

was lowest in the 2–2.9-month-old and 3–3.9-month-old groups (5% and 8%). Between 4 and 7 months of age, this figure was constant, at about 18%. Animal milk was also given to very few infants, between 2 and 9%, with no clear relation to age. Only one infant, <4 months old, had eaten family diet the day before the survey. Between the ages of 5 and 9 months, the ratio increased rapidly. At age 6 months, when daily supplements are recommended for all infants, 36% had been given family diet: at age 7 months, 64% of the infants had eaten family diet the day before the survey. From age 9 months, over 80% of infants had been given family diet.

The ratio of infants who had had nothing besides breast milk and water the day before the survey declined from 90% at age 2–3 months to 70% at age 4–5 months and 44% at 6 months. As late as 9–10 months, 13–14% of infants had still been given only breast milk and water the day before. Weaning patterns were similar for male and female infants (results not shown).

The 24-h recall did not provide a complete picture of feeding patterns, since food was not given daily once it had been introduced to a child. Complementary information included the

ratio of children who had eaten a given type of food in their lives. The proportion of children who had been totally breastfed throughout their lives declined from 81% at 2 months to 51% at 4 months, 21% at 6 months and 5% at 9 months. The proportion of infants who had already been fed millet gruel increased from 13% at 2 months to 20% at 3 months, 35% at 4–5 months and about 50% after 7 months. The proportion of children who had been fed family diet at least once increased from 2% before 4 months to 18% at 4 months, 34% at 5 months, 65% at 6 months and 80–90% after 7 months.

The comparison of results from the 24-h recall and the lifetime recall shows that at 5–10 months, feeding with family diet was often occasional rather than daily; at 6–6.9 months, for instance, family diet had already been given at least once to 65% of infants, but only 36% had eaten it the day before the survey. Similarly, while only 21% of children in this age group had been given no supplements to breast milk since birth, 44% had had no supplements the day before the survey. Thus, in this community weaning practices differ from those of Western countries where additional food is given virtually every day, at least after the age of 6 months.

Mothers were systematically asked why they had introduced millet gruel. The reasons invoked involved either perceived breast-milk insufficiency or the impression that the baby was undersized and weak. The reason generally given for introducing the family diet was that the child was old enough to begin this diet. Criteria for participating in the family meals included stable sitting and capacity to take handfuls from the common dish.

From the 24-h recall the mean number and timing of meals was calculated. Breast feedings were not considered. The number of meals given did not vary significantly with age, with a mean ranging from about 1.7 meals at 2–8 months to 1.9 at 9–10 months. No child ate more than three meals per day. The number of daily meals varied according to the type of food given. Infants who ate millet gruel had significantly more meals than infants given a family diet ($P < 0.001$). The difference was significant from age 4 months (Table 2). The feeding of gruel did not exclude other meals in older infants. However, as might be expected, infants given gruel ate a family diet less often than those given no gruel (34.5% *vs* 51.4%, $P < 0.05$ at age 6–7.9 months).

Table 2 Mean number of meals (additional food only), by type of meal

	Infants given gruel		*Infants given other foods*	
Age (months)	*n*	*Mean*	*n*	*Mean*
2–3.9	22	2.0	14	1.5
4–5.9	56	2.1	35	1.2***
6–7.9	55	1.9	141	1.5***
8–10.5	34	2.5	197	1.8***

***$P < 0.001$.

The distribution of meals during the day is given in Fig. 2. Most meals were eaten at noon, followed by the morning, while very few children ate in the evening. In the community under study, the evening meal is generally rather late, after 8pm when the infants are already asleep.

As seen above, the staple food in the study area is cereal. Because of their high protein and mineral content, consumption of foods of

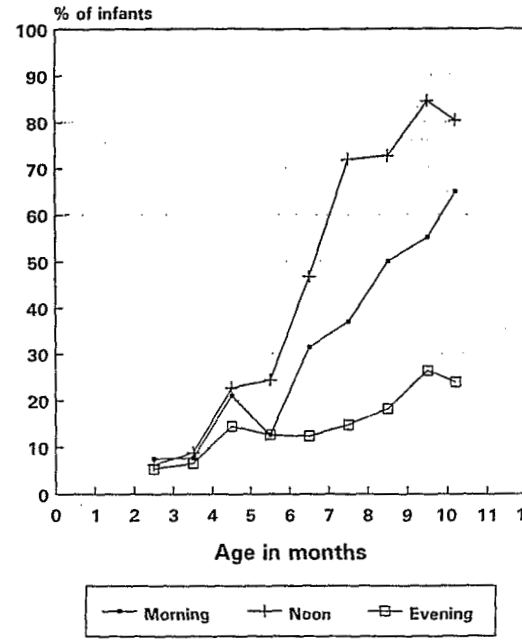

Fig. 2. Frequency of meals during the day preceding the survey, by age.

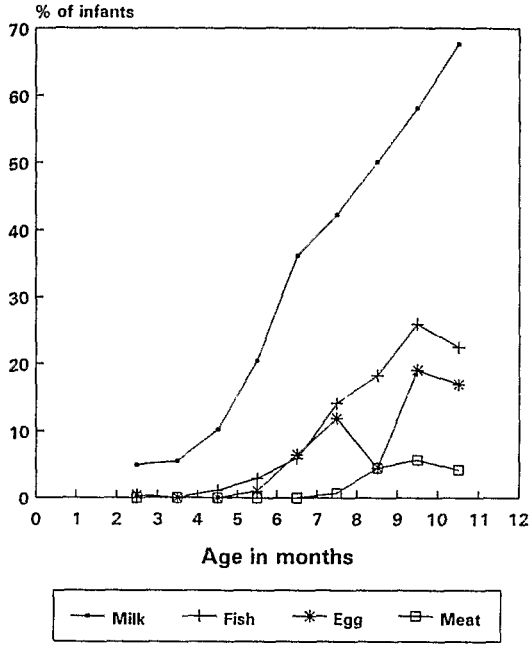

Fig. 3. Proportion of children who had eaten sour milk, fish, eggs or meat in their lifetime.

animal origin (animal milk, fish, egg, meat) will be described separately (Fig. 3). These food items were seldom eaten by the infants under study. Sour milk was the most frequent food item. It was introduced early; 5% of 2-month-old infants had already eaten it, and by 8 months, half of the infants had eaten it. Fish and eggs were introduced from 5 months on. At age 9 months, 20–25% had eaten at least one of these foods. Meat, which in this community is mainly consumed on special occasions such as religious ceremonies, had only been eaten by 6% of the 9-month-old babies. From discussions with the mothers, it was clear that even when the family diet contained fish, the latter was usually not given to the infant. The reason did not involve religious or nutritional taboos, but rather the fact that the mothers were simply afraid of inducing expensive eating habits in their children and preferred that their babies did not become accustomed to eating fish.

The relationship between weaning patterns and nutritional status was described according to age. Length-for-age and weight-for-length were compared according to foods given the day before the survey. Children who had been given any type of additional food were compared to children who had received only breast milk (Fig. 4). Overall, mean length-for-age was lower among children who had eaten additional food when adjusted for age ($P < 0.01$). The greatest difference was observed in the 2–3-month age group (height-for-age Z: –0.81 *vs* –0.27), which was the only subgroup with a significant difference in partial comparisons (t-test; $P < 0.01$). Mean weight-for-length was also lower among children who had eaten

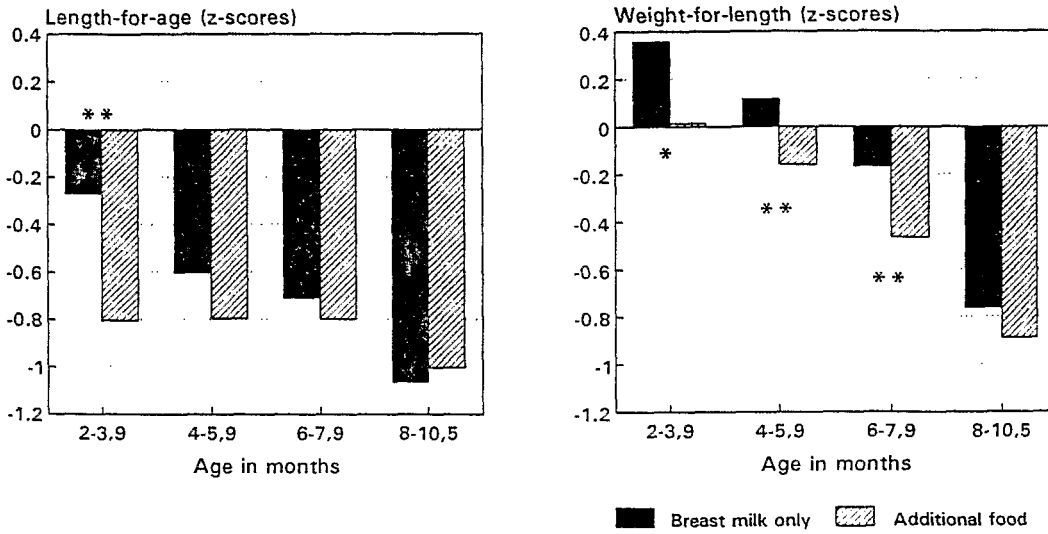

Fig. 4. Nutritional status by consumption of additional food.

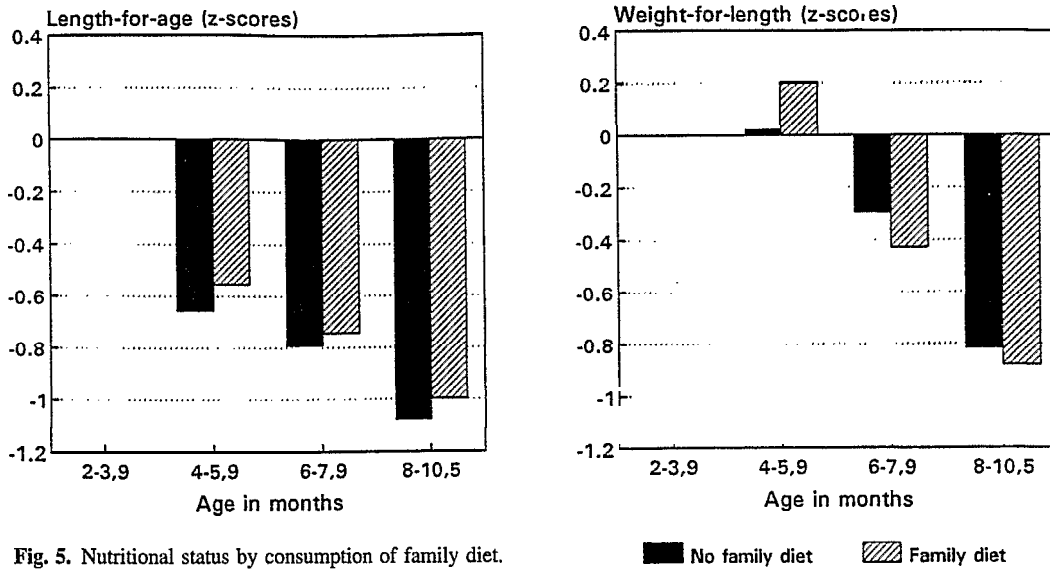

Fig. 5. Nutritional status by consumption of family diet.

additional food the day before the survey when adjusted for age (P = 0.001). Partial comparisons showed significant differences at the 0.0125 level (Bonferroni's Inequality) for the 4–5-month age group (weight-for-height Z: –0.16 *vs* +0.12) and for the 6–7-month age group (weight-for-height Z: –0.47 *vs* –0.17). Only 36 infants aged 2–3 months had been eating additional food, lending little power to the t-test in that age group (weight-for-height Z: 0.01 *vs* 0.36, P = 0.018).

From these results, it is thus clear that consumption of additional food is associated with a low nutritional status in this community, both in terms of length-for-age (younger infants) and in terms of weight-for-length. Since the reason given by the mothers for the introduction of additional food varied according

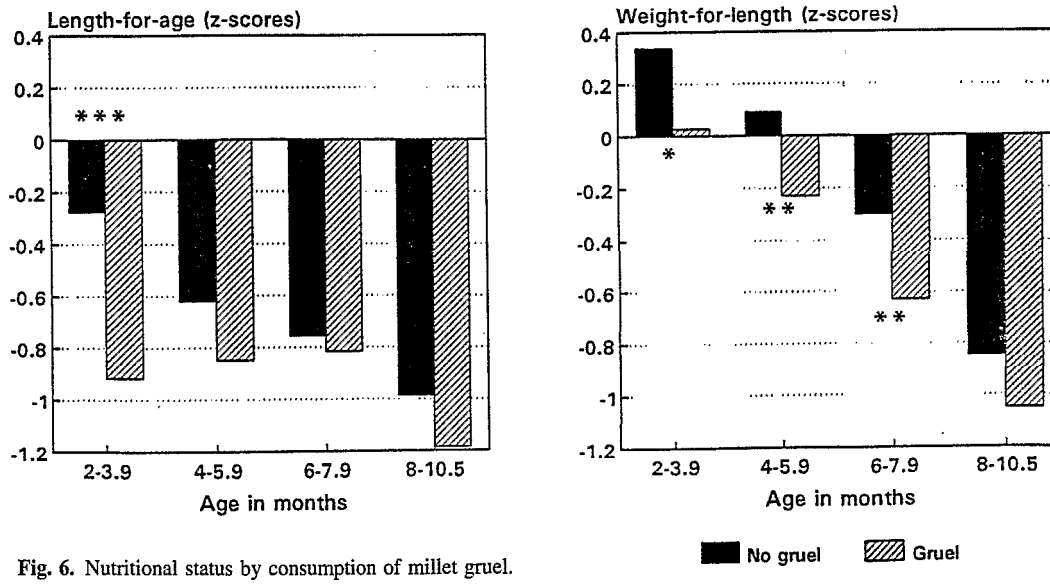

Fig. 6. Nutritional status by consumption of millet gruel.

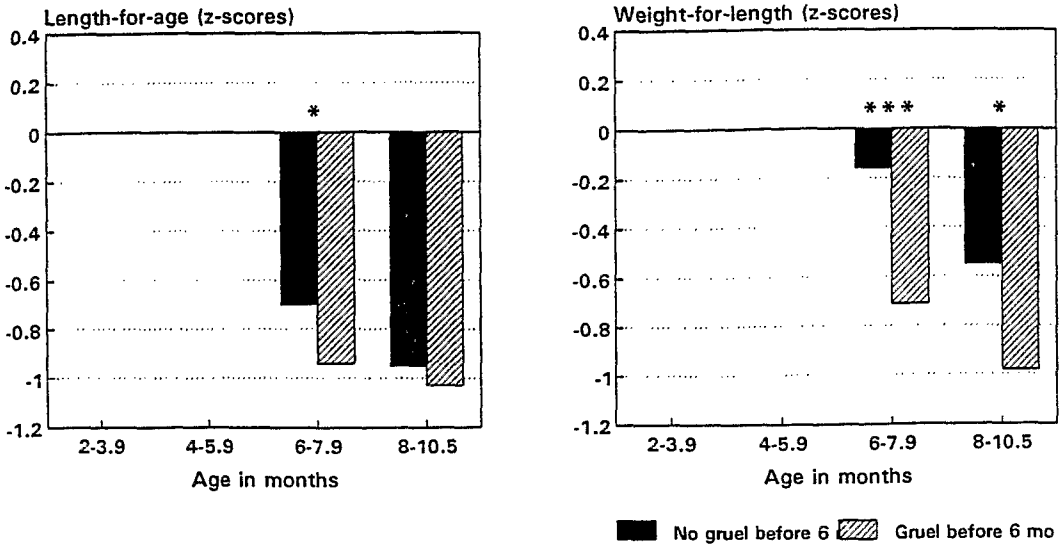

Fig. 7. Nutritional status of infants over 6 months of age, by consumption of millet gruel before 6 months.

to the type of food, i.e. millet gruel or family diet, the analysis of the relationship with nutritional status was performed separately for these prevalent types of food. The relationship between the nutritional status and the consumption of family diet the day before the survey was tested between 4 and 10 months, since only one infant under 4 months had eaten from the family diet. No significant relationship was found, either in length-for-age or in weight-for-length (Fig. 5). However, there was a tendency toward *greater* length-for-age among children who had been eating the family diet.

The negative relationship between nutritional status and additional food consumption was due entirely to consumption of millet gruel (Fig. 6). The overall association was highly significant, both with length-for-age ($P < 0.001$) and with weight-for-length ($P = 0.0001$). Partial comparisons showed significant differences at 2–3 months for length-for-age ($P = 0.001$), and at 4–5 months ($P < 0.01$) and 6–7 months ($P < 0.0125$) for weight-for-length. In conclusion, infants who ate millet gruels were smaller than others during early infancy and thinner than others throughout most of their infancy.

Since mothers were questioned as to the age of the child upon introduction of millet gruel, it was possible to test whether the infants who had consumed millet gruel during the first 6 months of infancy continued to suffer from a lower nutritional status than the others during the last 6 months of infancy. A total of 579 children were 6 months or older. Among these, 293 had never eaten millet gruel, while 279 had eaten it on at least one occasion. Among these 279, 241 were included in the early consumption group; 43 were excluded because consumption had started after 6 months; 22 were excluded because the mother did not remember the age at introduction. The nutritional status at 6–10 months of children who had consumed gruel during early infancy was lower than that of children who had never eaten gruel. The former were both shorter ($P < 0.05$) and thinner ($P < 0.0001$) than the latter (Fig. 7).

Discussion

Information on infant feeding was collected by means of interviews with the infants' mothers rather than by direct observation. Since 24-h recalls depend upon the mothers' information, biases may occur. Mothers may give incorrect answers if they feel that the interviewer considers that their infant should have had additional food earlier or later than when it was actually given. However, during the study, care was taken not to comment on mothers' feeding practices; moreover, no public health campaigns on infant feeding practices have taken place in the area.

Breastfeeding is universal in the study area, as in most rural African populations. One

hundred per cent of infants had been breastfed on the day before the survey. According to exhaustive longitudinal studies in the area, median age at arrest of breastfeeding is 26 months (Projet Niakhar, 1992).

The weaning patterns described herefor the Niakhar study area are quite different from the recommendations of the WHO. In this rural African population, all 1174 infants were breastfed as recommended, but none was exclusively breastfed, since they all received water. Water consumption was begun during the first week of life (results not shown). Water consumption has been shown to increase the risk of diarrhoea in otherwise exclusively breastfed infants from developing countries (Brown *et al.*, 1986). In Pakistan, a seasonal pattern in water consumption has been observed, with some infants being exclusively breastfed during the cool season and receiving water during the hot season (Ashraf *et al.*, 1993). In the present study, no seasonality was observed. Since the study was conducted partly in December, which is one of the coldest months of the year, it is likely that water is given all around the year in this area. Mothers are convinced of the necessity of water consumption in this Sahelian area where temperatures reach 43–45°C at the end of the dry season.

Introduction of additional food was begun too early in many infants; at 3–3.9 months, more than 25% had already eaten some kind of additional food at least once. If we consider only the day before the survey, 10% of infants in that age group had eaten additional food. However, introduction of additional food was not started as early as in some Third World communities such as East Java, where almost 90% of infants were force-fed from 4 weeks of age (van Steenbergen *et al.*, 1991). While some infants received additional food too early, one-fifth of children aged 6–6.9 months had never been given any additional food, and this is too late according to international recommendations (Underwood & Hofvander, 1982; WHO, 1985). Considering only the day before the survey, almost one-half of the 6–6.9-month-old infants did not receive any additional food. The nutritional status of completely breastfed infants aged 6–10.5 months was no different from the status of infants receiving additional food. Clearly, a selection effect is occurring, since mothers of heavy babies explained that they postponed introduction of supplements because they 'had enough milk'.

Frequency of administration is an important feature of infant feeding. In the area studied here, feeding with additional food was not done daily in supplemented infants. Even the family meal, which did not require any additional work on the part of the mothers, was not given every day once it was introduced. This finding has implications at both a methodological and a public health level. When studying feeding practices, 24-h recalls are generally used, because most mothers will be able to remember foods given for a short, recent period; the information obtained is therefore precise and reliable. However, when interpreting results of such studies, one should bear in mind that an unknown number of infants classified as totally breastfed are eating additional food either occasionally or regularly. At the public health level, such irregular consumption of additional food is unlikely to contribute a great deal to the energy intake. Occasional consumption of some foods might add significant amounts of nutrients; sour milk, for example, is rich in protein, calcium, vitamin A and zinc (Brown, 1991), but watery millet gruel has low nutrient content and bioavailability (Anonymous, 1991).

Possible explanations for occasional supplementation are manifold. Irregular feeding with millet gruel may be due to the heavy work load of the mother, while motivation is another important factor. Mothers may be discouraged by the poor growth response of the infant or by unwillingness on part of the infant to take the food. Low palatability was the most common reason given by mothers for stopping supplementation with millet gruel. Like millet gruel, family diet was seldom given daily during the first months after introduction, although no special preparation was needed. One possible explanation for irregular infant feeding with family diet is that it may not be given primarily for nutritional reasons, but rather for cultural reasons; to introduce the infant into the group around the common dish, and to accustom the child to eating solids. In addition, morbidity levels are high in this rural community and sick infants often refuse additional foods and consume nothing but breast milk for several days. Finally, irregular supplementation might impair breast-milk production less than daily supplementation, so that total energy intake is higher

using irregular supplementation than daily supplementation for the 6–7-month-old child. Further research is needed to clarify this issue.

In the rural Senegalese area studied here, feeding with specific weaning food is decided by the mothers in response to perceived low growth or poor breast-milk intake. Our results suggest that their perception is correct, since early supplemented infants (age 2–3.9 months) are both shorter and thinner than the others. Stunting seems to be an important determinant in early administration. Thus, low nutritional status induces supplementation with specific weaning food. Another possible interpretation of the negative relationship between nutritional status and gruel consumption might be that infants fed with millet gruel grow more slowly than exclusively breastfed children because of its high bacterial contamination, inducing frequent diarrhoea (Black *et al.*, 1982; Rowland, Rowland & Cole, 1988) and because of its low energy density. Brown & Bégin (1993) give average energy densities of 20–30 kcal/100 g in West African cereal gruels. It is probable that both interpretations are valid: small, short babies are supplemented earlier, and this supplementation further impairs their growth status due to diarrhoea and drop in breast-milk intake. Longitudinal studies are necessary to provide answers to this question, since randomized trials are not possible.

Rowland (1986) found that urban Gambian infants who received additional food were significantly lighter in weight than totally breastfed infants between the ages of 4 and 9 months. Length was not measured in that study, so wasting and stunting could not be detected. The impact of nutritional status on the introduction of additional food was tested: for the age span 3–6 months, infants who were to receive additional food during the following month were lighter than those who would remain totally breastfed. In Gambia, mothers thus accurately interpret the growth of their infants, and introduce additional food earlier in lighter weight infants. In other African communities, no association between nutritional status and introduction of additional food has been found. In Sudan, Zumrawi, Dimond & Waterlow (1987) followed a large cohort of children from birth to definitive weaning (arrest of breastfeeding). Children who were to begin consumption of additional food in the following month were neither lighter nor heavier than those who were to remain totally breastfed. The median age at introduction of additional food was 15 weeks (3.5 months). Growth measured as weight gain was similar in infants with and without additional food. In a rural area of Kenya, Kusin *et al.* (1985) studied infant growth and feeding patterns longitudinally. Weaning patterns were very different from those described in the present study, since virtually all infants received additional food (mainly cow's milk) at 3 months of age. No significant relationship between weight-for-age and the consumption of additional food was found.

As mentioned above, longitudinal studies are necessary to determine whether supplemented infants have different morbidity and growth patterns than non-supplemented infants before and after adjustment for early nutritional status. However, it is clear that the composition of weaning food in the rural area studied here is far from optimal, and that improvements are needed. Much attention has recently been paid to weaning food technology research, with special attention to improvement in the energy density and nutrient content (Anonymous, 1991; Brown & Bégin, 1993). These topics are important but the emphasis on weaning food research should not compete with research on improvement in breast milk consumption in small, thin babies, especially before the age of 6 months.

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