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Abbreviations

ANRS, Agence Nationale de Recherches sur le Sida; CI, Confidence Interval; FF, Formula Feeding; HAZ, Height-for-Age *z* score; HIV, Human Immunodeficiency Virus; SD, Standard Deviation; WAZ, Weight-for-Age *z* score; WHZ, Weight-for-Height *z* score; WHO, World Health Organization.

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ABSTRACT

Background. In high HIV-prevalence resource constrained settings, exclusive breastfeeding with early cessation is one of the conceivable interventions aimed at the prevention of HIV through breastmilk. Nevertheless, this intervention has potential adverse effects such as the inappropriateness of complementary feeding taking over breastmilk.

Design. Prospective cohort study in Abidjan, Côte d'Ivoire.

Methods. HIV-infected pregnant women willing to breastfeed who had received a perinatal antiretroviral prophylaxis were offered to practice exclusive breastfeeding and initiate early cessation of breastfeeding from the fourth month to reduce breastmilk HIV transmission. Nature and ages of introductory complementary feeding were described in infants up to their first birthday by longitudinal compilation of 24 hour and seven day recall histories. These recalls were done weekly until six weeks of age, monthly until nine months of age, and then quarterly. We created an index synthesizing the nutritional adequacy of infant feeding practices (in terms of quality of the source of milk, dietary diversity, food and meal frequencies) ranging from 0 to 12. The association of this feeding index with growth outcomes in children was investigated.

Results. Among the 262 breastfed children included, complete cessation of breastfeeding occurred in 77% by their first birthday, with a median duration of four months. Most of the complementary foods were introduced within the seventh month of life, except for baby food and infant formula that were introduced at age four months. The feeding index was relatively low (5/12) at age six months, mainly due to insufficient dietary diversity, but was improved in the next six months (8.5/12 at age 12 months). Inadequate complementary feeding at age six months was associated with impaired growth during the next 12 months, with a 37% increased probability of stunting.

Conclusion. Adequate feeding practices around the weaning period are thus crucial to achieve optimal child growth. HIV-infected women should only turn to early cessation of breastfeeding when they are properly counselled to provide adequate complementary feeding taking over breastmilk. Our child feeding index could contribute to the assessment of the nutritional adequacy of complementary feeding around the weaning period and thus help detecting children at risk of malnutrition.

Medical subject headings: Africa; breast feeding; disease transmission, vertical; HIV infections; infant nutrition; nutritional status

The World Health Organization (WHO) and the United Nations Children's Fund have recently advocated for increased commitment to appropriate feeding practices for all infants and young children in order to achieve optimal growth, development and health (1). As a global public health recommendation, international guidelines stress that infants should be exclusively breastfed for six months, then frequent and on-demand breastfeeding should continue to 24 months and should be coupled with the gradual introduction of complementary feeding adapted to the child's requirements and abilities (2).

Nevertheless, this issue is particularly complex in high human immunodeficiency virus (HIV) prevalence resource constrained settings where HIV infected pregnant women face a dilemma regarding the feeding practices of their forthcoming infant (3). Indeed, in these settings where breastfeeding is widely practiced and usually prolonged one year after birth, the overall risk of HIV transmission through breastmilk was estimated to be 8.9 new cases per 100 child-years of breast-feeding (4). Several nutritional strategies are conceivable in urban settings to reduce this risk (5). One of them consists in the combined promotion of exclusive breastfeeding and early cessation of breastfeeding. Indeed, the shorter the breastfeeding period, the lower the cumulative risk of HIV transmission through breastmilk (6). Moreover, some observational evidence shows that exclusive breastfeeding carries a lower postnatal risk of transmission of HIV than breastfeeding with early introduction of other fluids or foods (7-9).

To be fully assessed, the benefits of such a nutritional intervention in terms of reduction of postnatal HIV transmission have to be balanced with their potential risks for infant health. Indeed, this nutritional intervention could also have potential adverse effects. One of these was that complementary feeding taking over breastmilk would not be nutritionally appropriate, whereas international guidelines stress that such a strategy should be coupled with the introduction of nutritionally adequate and safe complementary foods (10, 11).

We launched in 2001 a research study aimed at the prevention of mother-to-child transmission of HIV in Abidjan, Côte d'Ivoire, proposing to HIV-infected pregnant women willing to breastfeed to do it exclusively and to initiate early weaning (12). We had previously shown that among these breastfeeding mothers, the median duration of breastfeeding was reduced to four months, which was shorter than it was usually practiced in this population (13-15).

The purpose of our study was first to describe the nature and ages of introduction of complementary feeding among early weaned breastfed infants up to their first birthday ; and second to assess the nutritional adequacy of these complementary foods by creating a child feeding index, and to investigate its association with child nutritional status.

MATERIALS AND METHODS

Study area and population

The ANRS 1201/1202 Ditrame Plus study was conducted in Abidjan, the economic capital of Côte d'Ivoire. From March 2001 to March 2003, any pregnant woman, aged at least 18, attending one of the selected prenatal clinics and living within the limits of Abidjan was offered pre-test-counselling and HIV testing. Women who tested positive were offered to enter the study from 32 weeks of gestation after having been explained the objectives of the study, accepted the study protocol and signed an informed consent (16, 17).

Research design

Within this open-labelled cohort, women received a short peri-partum antiretroviral drug combination (12). Two nutritional interventions were hierarchically and systematically proposed to the women during prenatal visits (13). The first strategy consisted in complete avoidance of breastfeeding by providing artificial milk from birth. The second option consisted in practicing exclusive breastfeeding with the aim to obtain complete cessation of breastfeeding between three and four months of age. Breastfeeding women were encouraged to cup-feed their infants when initiating weaning. In all cases, replacement feeding until nine months of age as well as the material needed were provided free of charge and the staff supported the choice expressed by the women and counselled them accordingly.

Follow-up procedures

From birth up to the second birthday, 19 visits were scheduled for clinical, biological, nutritional and psychosocial follow-up of both mothers and infants. Mother-infant pairs were seen on study sites at birth, two days after delivery, weekly until six weeks of age, monthly until nine months of age, and every three months until the second birthday. Services dispensed by the study team were also available whenever needed between scheduled visits. All transport costs were reimbursed and all care expenses related to any clinical event were entirely supported by the project.

Nutritionists counselled individually the women on study sites about infant feeding practices whenever needed. Collective sessions were organized to help mothers to correctly position their baby to the breast, to reiterate the benefits of exclusive breastfeeding, how safely prepare artificial feeding, initiate weaning, use appropriate complementary feeding or cook the baby food.

At each scheduled visit, anthropometric measurements including height and weight were taken by trained staff according to standard procedures (18).

Collection of infant feeding practices

At each scheduled visit, infant feeding practices were recorded via structured questionnaires by trained social workers who were not involved in nutritional counselling. Women were asked if their child had been given breastmilk, artificial milk or both since the last visit. Fluids and foods other than breastmilk or artificial milk were also documented using a 24 hour and a seven day recall history. Social workers went over a detailed list of commonly used fluids or foods. Women were asked if these fluids, foods or some other items not listed had been given in the previous seven days, and if so how many times on the day before (24 hour recall history) and how frequently in the past seven days.

Infants were classified at each scheduled visit as exclusively or predominantly breastfed, mixed fed or artificial fed using these recall histories (19). Being exclusively breastfed from birth at a given time meant having been classified in this category at all the preceding visits since birth. We used the following WHO definitions to allow a better comparability of results between studies. *Exclusive breastfeeding* means giving a child no other food or drink, including no water, in addition to breastfeeding with the exception of medicines, vitamin drops or syrups, and mineral supplements (20). *Predominant breastfeeding* means breastfeeding a child but also giving small amounts of water or water based drinks. Neither food-based fluid nor solid food are allowed under this definition (20). *Artificial feeding* means feeding a child on artificial feeds (including infant formula and powdered animal milk), and not breastfeeding at all (21). *Mixed feeding* means breastfeeding while giving non-human milk such as infant formula or food-based fluid or solid food (22).

We defined the *weaning process* as the period from the introduction of the first weaning food till complete cessation of breastfeeding. We defined *baby food* as cereal based baby food enriched with powdered animal milk. The term *weaning food* was used for all solid foods and/or any breastmilk substitutes (such as infant formula).

Child feeding index

To assess the nutritional adequacy of complementary feeding, we created an index synthesizing multiple dimensions of child feeding practices on the basis of both current infant feeding recommendations and Ruel and Menon previous work on the subject (2, 10, 23). This child feeding index was adapted to the context of the Ditrame Plus study, where women were encouraged to exclusively breastfeed during four months, then replace breastmilk by formula feeding until nine months of age. From weaning initiation, women were also encouraged to provide milk sources to their infant through baby food enriched with powdered animal milk, and dairy products. The scoring system used to create the child feeding index at ages six, nine and 12 months is detailed in table 1. The more positive the nutritional practices were, the higher scores assigned were. This index was a summation of four sub-scores which are detailed below, and ranged from 0 to 12.

A source of milk score was created on the basis of the foods containing milk consumed by the child in the previous 24 hours. Nutritionally speaking, breastfeeding was the best practice. But on the other hand, breastfeeding beyond six months of age is associated with an increased risk of postnatal transmission of HIV, which needs to be taken into account in the appropriateness of this practice. A score of "1" was thus assigned to breastfed children. In our context where non-breastfeeding carried a much lower risk of HIV transmission, we decided to assign the same positive score to formula fed children, but only when the women reported to have prepared the correct amounts of feeds. Cereal based baby foods enriched with powdered animal milk and dairy products were considered as substantial sources of milk and thus assigned positives scores.

A dietary diversity score was created on the basis of the number of food groups consumed by the child in the previous 24 hours. Emphasis was made on animal products as meat, fish and eggs on the one hand, and products containing animal milk (dairy products and baby food) on the other hand and constituted two food groups. Vegetables and fruits which are important sources of vitamins and are rich in dietary fibre, and tubers, grain and starchy foods which are staple diet in this setting constituted another two food groups. Considering that all of these food groups were essential to ensure a high dietary diversity, a score of "1" was assigned to each of them.

A food frequency score was based on the number of days the children consumed each of these food groups in the previous week. The scoring depends on the age of the child and is detailed in table 1.

A meal frequency score was based on the number of meals (complementary foods) in the previous 24 hours. A maximum score of "2" was given to children who had received complementary feeding at least twice a day at age six months, and at least three times a day at ages nine and 12 months.

Statistical analysis

The following analyses were conducted among women whose live-born infant was initially classified as breastfed using the recall history obtained at the day two visit.

The probability of being breastfed was calculated from birth until one year of age, using the Kaplan Meier method. We also detailed the proportion of children who were in each feeding category at given ages.

The proportion of children who were ever fed each food item from birth up to 12 months of age and the median ages of introduction of these food items were calculated. For each food item and for each monthly or quarterly visit from birth up to 12 months of age, we reported the proportion of children who had been given this food item at least once in the previous week.

The mean and median values of the child feeding index were calculated at ages six, nine and 12 months. At each of these ages, the index was grouped into terciles to form three categories of child feeding practices: low, average or high, in order to assess the nutritional adequacy of complementary feeding.

The relationship between these three nutritional categories and long-term growth outcomes in children was also investigated. For this purpose, weight-for-age, height-for-age, and weight-for-length z scores were calculated on the basis of the sex- and age-specific growth charts references developed by the National Center for Health Statistics and the Centers for Disease Control and recommended for international use by WHO (24-26). The z score or standard deviation (SD) unit is defined as the difference between the value for an individual and the median value of the reference population for the same age or height, divided by the standard deviation of the reference population.

The mean *z* score were presented at ages nine, 12 and 18 months and compared between children with a low *vs.* an average or high index at age six months, and a low or average *vs.* a high index at ages nine and 12 months.

The cumulative probability of being stunted (defined as height-for-age *z* scores inferior to -2 SD) at least once from age seven months to age 18 months was compared between children with a low *vs.* an average or high index at M6, using the Kaplan-Meier technique (27, 28). Multivariate analysis used Cox's proportional-hazard models. This approach allowed for adjusting this comparison on potential confounding variables: maternal education, type of housing, low birth weight (<2500g) and paediatric HIV status (time dependant variable).

All statistical analyses were carried out with the use of SAS software (version 8.2; SAS Institute, Inc, Cary, NC).

Ethical permissions

The ANRS 1201/1202 Ditrame Plus study was granted ethical permission in Côte d'Ivoire from the ethical committee of the National AIDS Control Programme, and in France from the institutional review board of the French Agence Nationale de Recherches sur le Sida (ANRS). As part of the Ditrame Plus programme, the study presented here was included in the institutional review board approval.

RESULTS

Baseline study population characteristics

Among the 557 mothers included in the Ditrame Plus study who delivered a live birth, 262 (47 percent) initiated breastfeeding and constituted the breastfeeding group for the present analysis. Overall, 47 percent of these breastfeeding women were illiterate, 70 percent lived with their partner, all but eight had electricity at home, and all had at least access to tap water in their yard. Three quarter of them lived in a typical shared housing with several houses organized around a yard where inhabitants live in crowded accommodation and share kitchen and restroom.

Breastfeeding characteristics

At 12 months of age, 77 percent of these mothers had completely ceased breastfeeding. Complete cessation of breastfeeding occurred in median four months after delivery (Interquartile-range: 3, 5). The probabilities of being breastfed from birth until one year of age are represented on figure 1.

The majority of infants (60 percent) were predominantly breastfed from birth to age three months. At four months of age, 39 percent of the infants were mixed fed, 30 percent were predominantly breastfed, 8 percent were exclusively breastfed while the remainders were not breastfed any more. At this age, 83 percent of the mixed fed children were in the process of being weaned and were thus receiving both infant formula and breastmilk. From six months of age, most of the infants were not breastfed any more and received artificial feeding instead, while the remaining breastfed infants were essentially mixed fed.

Within our cohort, the cumulative probabilities of being exclusively breastfed from birth were 0.18 (95 percent confidence interval (CI): 0.13, 0.22), 0.10 (0.06, 0.13) and 0.01 (0, 0.02) at ages one, three and six months respectively. As detailed on figure 2, this low prevalence of exclusive breastfeeding could be explained by early common introduction of fluids such as water (essentially tap water, but use of mineral water was also relatively common early in life). Indeed, 98 percent of the infants had ever been given water from 8 days of age in median. Other fluids such as herbal tea or fruit juice were widely used but introduced later, i.e. in median 12 weeks and five months after birth respectively.

Ages of introduction and use of several food items

The proportion of children who had ever been given each item of a selection of food items, the age of introduction of each food item as well as the proportion of children who were given it at several ages are represented on figure 2. Most of the complementary foods were introduced within the seventh month of life, except for baby food and infant formula that were introduced earlier, i.e. around the median age of complete cessation of breastfeeding. Less than a third of infants had been given meat by their first birthday, but fish and eggs were widely used in this population, indeed respectively 83 percent and 74 percent of the children had received these food items by their first birthday.

Child feeding index and its relation to child growth

The values of the child feeding index scores at ages six, nine and 12 months are detailed in table 2. At all ages, all of the four sub-score values ranged from zero to the maximum possible value, namely two or four. At age six months, the mean values of the source of milk and meal frequency scores were satisfactory (1.63/2 and 1.41/2, respectively), whereas the dietary diversity and food frequency scores were low (inferior to 1/4), leading to a relatively low child feeding index score with a mean around 5 out of 12. At nine and twelve months of age, the dietary diversity and food frequency were more adequate (superior to 2.5/4), resulting to a considerably improved child feeding index. No statistically significant association were found at any of the three ages between maternal socio-demographic characteristics and the child feeding index categories (low, average or high).

As shown in table 3, a low compared to an average or high child feeding index score at age six months was associated with a significantly lower mean height-for-age *z* score at ages 12 and 18 months, and a lower mean weight-for-age *z* score at ages nine, 12 and 18 months. No statistically significant associations were found between the values of the child feeding index at ages nine and 12 months and the *z* score values in the subsequent months. Very similar results were obtained when excluding HIV-infected children (data not shown). Given the relatively small number of HIV-infected children, they were not examined as a separate stratum.

The relationship between the child feeding index score at age six months and the cumulative probability of stunting in the following year was further investigated and detailed on figure 3. Children with a low child feeding index score at age six months had a 37 percent increased risk of being stunted at least once from ages seven to 18 months compared to those with an average or high index (p=0.03). This association was even stronger after adjustment on variables potentially linked to this growth outcome. Indeed, in a multivariate analysis, the occurrence of stunting was significantly associated with a low child feeding index at age six months (relative risk: 1.5, 95% CI: 1.1-2.0), the diagnosis of paediatric HIV infection (13.9, 10.3-19.0) and mother's illiteracy (1.6, 1.2-2.1). But it was not associated with low birth weight (1.1, 0.6-2.0) or the fact of living in a typical shared housing (1.0, 0.9-1.3).

DISCUSSION

To our knowledge, this study is the first to prospectively describe the nature and ages of introduction of complementary feeding, detail the adequacy of these complementary foods and its implications on nutritional status among early weaned breastfed children born to HIV infected mothers in an urban African context.

Within the Ditrame Plus study, complete breastfeeding cessation was obtained around the fourth month of age, after a short (nine days in median) transition period of mixed feeding when breastmilk and infant formula were simultaneously given to the infant (13). After this weaning process, breastfeeding was replaced by infant formula and baby food enriched with powdered animal milk, allowing thus to cover the nutritional requirements in terms of source of milk. However, the dietary diversity was not appropriate in the very first months following this weaning process. Indeed, fruits, vegetables and staple or animal products such as fish, meat, or eggs were introduced later, from the seventh month of age in median. Moreover, infant feeding practices during the critical period around the weaning process appeared to be a predictor of the future child nutritional status. Indeed, inadequate complementary feeding at age six months was strongly associated with impaired growth and increased probability of stunting during at least the next 12 months. This could indicate a critical importance of this age concerning the development of the child. After this crucial period of transition, the nutritional adequacy of complementary feeding was considerably improved to cover the nutritional needs of most of the children at ages nine and 12 months. As a result, the values of the child feeding index at these later ages were not associated any more with growth outcomes in the subsequent months. This nutritional adequacy improvement could be explained by the continuous nutritional counselling provided by the study team, but also by the fact that women in Abidjan are more accustomed to weaning from nine months of age rather than earlier (15). It is however also possible that the child feeding index was not as sensitive at detecting infants receiving inadequate complementary feeding at ages nine and 12 months as it was at age six months.

We had previously reported that the women included in the Ditrame Plus cohort were quite representative of the general population of Abidjan as they had been recruited among all attendees of community run health facilities located in poor areas, with no other selection criteria than being HIV infected, at least 18 years old, and having accepted the study protocol (12, 13). Given this resource-limited environment, breastmilk substitutes (infant formula) were provided for free from the initiation of the weaning process until nine months of age completed. This needs to be taken into account as it contributed to the nutritional accuracy of the source of milk provided to the infants.

This prospective study provided detailed information on infant feeding practices from birth with a reasonably high level of precision. Indeed, emphasis was made on the collection of nutritional data with the use of standardized forms to perform the recall histories, the frequent visits scheduled over the follow-up period and interviews conducted by trained health care workers other than those who counseled the women on infant feeding practices. This strategy minimized the maternal recall bias that could have impaired the estimation of the complementary feeding characteristics (29, 30). The fact that the previous week of food consumption is not necessarily representative of long-term usual feeding practices might constitute another limitation. Indeed, food could have been introduced in intervals not covered by the interviews, which could have overestimated the age this food was introduced. Nevertheless, all complementary foods were introduced during the first nine months of age, a period when interviews were conducted at least once a month, which contributed to minimize this limitation. Moreover, the longitudinal and regular compilation of several 24 hour and seven day recall histories tends to reliably reflect the feeding pattern all over the study period.

Assessing the nutritional adequacy of complementary feeding is complex as qualitative (food diversity, food frequency) but also quantitative (number of meals, exact amount of each food group, nutrient intakes, total energy intake, vitamin coverage) dimensions of infant feeding practices need to be taken into account. The child feeding index we used was essentially qualitative and could have been improved by assessing quantitative dimensions of child feeding practices. Nevertheless, this evaluation would have been difficult in a context where most of the mothers were illiterate. Moreover, it would have been unpractical as the recall histories already lasted half an hour, in a study with multiple judgment criteria where mothers had also to be interviewed by a clinician for their child and for their own health at each visit.
We believe that thanks to this child feeding index, our study provides a reliable longitudinal view of the evolution of both characteristics and nutritional adequacy of infant feeding practices among early weaned breastfed children. Moreover, this study highlights the critical period when such an index could be a predictor of the future child growth outcomes.

The relationship between the different categories of the child feeding index and the nutritional status of the children was assessed using anthropometric indices. The cumulative probability of low height-for-age was assessed as it reflects a process of failure to reach linear growth potential as a results of suboptimal health and/or nutritional conditions (28). As stunting is a severe event in low income countries, especially when it starts early in infancy (31), our intent was to detect the proportion of infants exposed at least once to this risk. This analysis was coupled with the estimations of the mean z-scores. We believe the analysis of the trajectory of height or weight for age would have been more difficult to interpret. Indeed, a relatively high standard of care was proposed within our study: closed clinical and nutritional follow-up adapted to the child age and free provision of care. Children presenting a z-score below -2SD were consequently expected to be clinically and nutritionally managed which would have positive consequences on growth velocity.

We assumed poor growth was a consequence of the nutritional inadequacy of the complementary feeds. Poor growth could also come from illness associated with not receiving the immune protection from breastmilk. However, the relationship between infant feeding practices and the occurrence of interim illness is difficult to interpret because of a reverse causation bias (32). In addition, poor growth could come from receiving contaminated foods. All the women included in the study had access to tap water. But as two thirds of them lived in typical shared housing, the tap was mainly outside home. It had been previously reported that the quality of municipal water in Abidjan was rather good, but that household water storage was a common practice that contributed to contaminate drinking water (33). Within our study, women were encouraged to avoid water storage, but a third of them reported to have ever given stored water to their child (figure 2). Such a practice might have had adverse consequences on infant health.

Several studies conducted in resource-constrained countries, where breastfeeding was long-term prolonged, had underlined that the protection against mortality provided by breastmilk tended to decline with age and was probably due to both lower breastmilk intakes and inaccurate complementary feeding (32, 34). Our study provides useful knowledge on this issue in the context of a nutritional intervention aimed at the prevention of HIV through breastmilk, underlying that adequate feeding practices around the weaning period appear to be crucial to achieve optimal child growth. In resource-limited countries, HIV infected women should therefore only turn to early cessation of breastfeeding when they are counselled to provide to their child adequate complementary feeding taking over breastmilk. In this context, we thus strongly believe that emphasis should be made on innovative ways to properly counsel women on infant feeding so that the public health messages could be adapted to their individual situations.

Ideally, the child feeding index presented here could be routinely used, especially around the weaning period, in order to contribute to the assessment of the nutritional adequacy of complementary feeding. This index could thus help detecting children at risk of malnutrition who need to be managed with an appropriate and reinforced nutritional counselling. Nevertheless, other prospective studies are needed to fully assess the accuracy of this child feeding index to early detect children at risk of malnutrition in other settings and circumstances.

APPENDIX

Composition of the ANRS 1201/1202 Ditrame Plus Study Group

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Conflict of interest

None of the authors had any conflict of interest to declare.

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TABLE 1. Scoring system used to create the child feeding index for children at each age.

	Age 6 Months	Age 9 Months	Age 12 Months
Source of Milk (past 24 hours)	Breastmilk = 1 FF - correct amount * = 1 FF - wrong amount = 0 Baby food or dairy product = 1	Breastmilk = 1 FF - correct amount † = 1 FF - wrong amount = 0 Baby food or dairy product = 1	Breastmilk = 1 FF = 1 Baby food = 1 Dairy product = 1
Sub-score 1	*Maximum = 2*	*Maximum = 2*	*Maximum = 2*
Dietary diversity (past 24 hours)	Baby food or dairy product = 1 Vegetables or fruits = 1 Tubers or starchy food = 1 Meat or fish or egg = 1	Baby food or dairy product = 1 Vegetables or fruits = 1 Tubers or starchy food = 1 Meat or fish or egg = 1	Baby food or dairy product = 1 Vegetables or fruits = 1 Tubers or starchy food = 1 Meat or fish or egg = 1
Sub-score 2	*Maximum = 4*	*Maximum = 4*	*Maximum = 4*
Food frequency (past 7 days)	For each of: baby food/dairy product, vegetables/fruits, tubers/starchy food, meat/fish/egg 0 times in past 7 days = 0 1-2 times in past 7 days = 0.5 3 times or more in past 7 days = 1	For each of: baby food/dairy product, vegetables/fruits, tubers/starchy food, meat/fish/egg 0 times in past 7 days = 0 1-3 times in past 7 days = 0.5 4 times or more in past 7 days = 1	For each of: baby food/dairy product, vegetables/fruits, tubers/starchy food, meat/fish/egg 0 times in past 7 days = 0 1-3 times in past 7 days = 0.5 4 times or more in past 7 days = 1
Sub-score 3	*Maximum = 4*	*Maximum = 4*	*Maximum = 4*
Meal frequency (past 24 hours)	0 meals a day = 0 1 meal a day = 1 2 or more meals a day = 2	0 meals a day = 0 1-2 meals a day = 1 3 or more meals a day = 2	0 meals a day = 0 1-2 meals a day = 1 3 or more meals a day = 2
Sub-score 4	*Maximum = 2*	*Maximum = 2*	*Maximum = 2*
Total score ‡	Maximum = 12	Maximum = 12	Maximum = 12

FF: formula feeding ; baby food: cereal based baby food enriched with powdered animal milk
* at least equivalent to the amount of two 210 mL feeds ; † at least equivalent to the amount of one 210 mL feed ; ‡ sum of sub-scores 1 to 4

TABLE 2. Child feeding index scores at ages six, nine and twelve month. Abidjan, Côte d'Ivoire, 2001-2005.

	Age 6 Months		Age 9 Months		Age 12 Months	
Source of Milk (past 24 hours)	Breastfeeding	35%	Breastfeeding	24%	Breastfeeding	23%
	FF - correct amount	52%	FF - correct amount	62%	FF	54%
	FF - wrong amount	12%	FF - wrong amount	12%	Baby food / dairy product *	23%
	Baby food / dairy product *	1%	Baby food / dairy product *	2%		
Sub-score value †	1.63 (0.53)		1.73 (0.47)		1.65 (0.58)	
Dietary diversity (past 24 hours)	Baby food / dairy product	76%	Baby food / dairy product	87%	Baby food / dairy product	83%
	Vegetables / fruits	5%	Vegetables / fruits	41%	Vegetables / fruits	52%
	Tubers / starchy food	3%	Tubers / starchy food	46%	Tubers / starchy food	50%
	Meat / fish / egg	14%	Meat / fish / egg	78%	Meat / fish / egg	89%
Sub-score value †	0.98 (0.71)		2.51 (1.11)		2.75 (1.06)	
Food frequency (past 7 days)	3 times or more of:		4 times or more of:		4 times or more of:	
	Baby food / dairy product	74%	Baby food / dairy product	82%	Baby food / dairy product	77%
	Vegetables / fruits	2%	Vegetables / fruits	33%	Vegetables / fruits	45%
	Tubers / starchy food	3%	Tubers / starchy food	45%	Tubers / starchy food	52%
	Meat / fish / egg	8%	Meat / fish / egg	70%	Meat / fish / egg	82%
Sub-score value †	0.90 (0.64)		2.49 (1.08)		2.70 (1.12)	
Meal frequency (past 24 hours)	0 meal	21%	0 meal	5%	0 meal	3%
	1 meal	15%	1-2 meals	57%	1-2 meals	55%
	2 or more meals	64%	3 or more meals	38%	3 or more meals	42%
Sub-score value †	1.41 (0.82)		1.32 (0.57)		1.39 (0.54)	
Total score †	4.93 (2.29)		8.06 (2.47)		8.49 (2.55)	
‡	6 (5-6)		8.5 (7-9)		9 (7.5-10)	

FF: Formula feeding ; * baby food or dairy product only i.e. no breastmilk nor formula feeding ; † mean (standard deviation) ; ‡ median (33rd percentile - 66th percentile)

TABLE 3. Relationship between mean Height-for-Age *z* score, Weight-for-Age *z* score and Weight-for-Height *z* score and child feeding index scores, at given ages. Abidjan, Côte d'Ivoire, 2001-2005.

	Mean *z* score at age 9 Months			**Mean *z* score at age 12 Months**			**Mean *z* score at age 18 Months**		
	HAZ	**WAZ**	**WHZ**	**HAZ**	**WAZ**	**WHZ**	**HAZ**	**WAZ**	**WHZ**
Child feeding index score at M6									
low	-1.10	-1.13	-0.04	-1.11	-1.62	-0.57	-1.07	-1.67	-0.77
average or high	-0.78	-0.80	0.10	-0.77	-1.23	-0.38	-0.67	-1.24	-0.59
p-value *	*0.10*	*0.04*	*0.41*	*0.04*	*0.03*	*0.31*	*0.01*	*0.02*	*0.30*
Child feeding index score at M9									
low or average				-0.95	-1.47	-0.54	-0.88	-1.47	-0.72
high				-0.76	-1.17	-0.28	-0.70	-1.22	-0.49
p-value *				*0.27*	*0.12*	*0.17*	*0.31*	*0.19*	*0.21*
Child feeding index score at M12									
low or average							-0.88	-1.47	-0.70
high							-0.79	-1.33	-0.60
p-value *							*0.61*	*0.50*	*0.56*

HAZ, Height-for-Age *z* score; WAZ, Weight-for-Age *z* score; WHZ, Weight-for-Height *z* score
* Student t-test on the equality of means

LEGENDS FOR FIGURES

FIGURE 1. Kaplan-Meier probability of being breastfed. Abidjan, Côte d'Ivoire, 2001-2005 (N=262).

FIGURE 2. Proportion of children who were given commonly used food items from birth up to age 12 months. Abidjan, Côte d'Ivoire, 2001-2005 (N=262).

FIGURE 3. Kaplan-Meier cumulative probability of height-for-Age *z* score<-2 from age 7 months to age 18 months according to child feeding index score at age 6 months. Abidjan, Côte d'Ivoire, 2001-2005 (N=262).

FIGURE 1

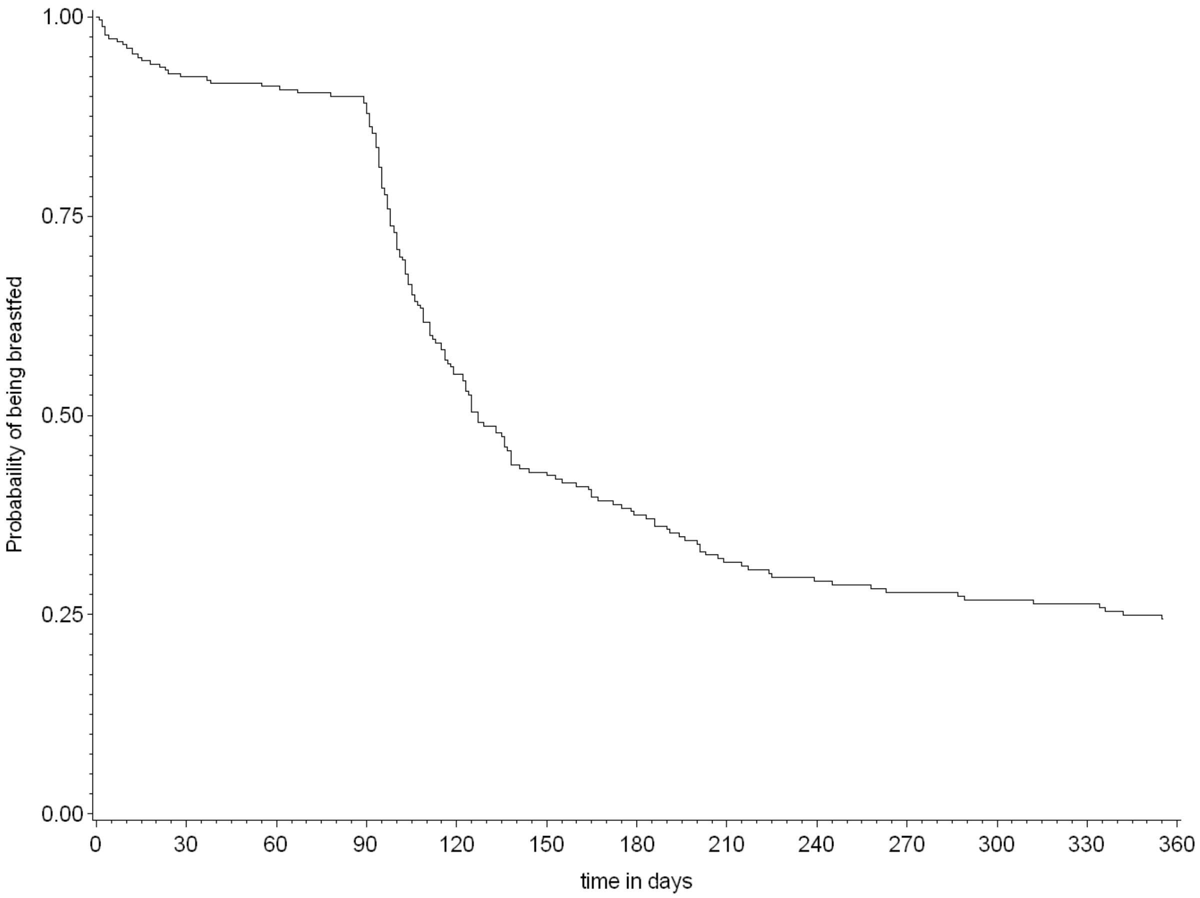
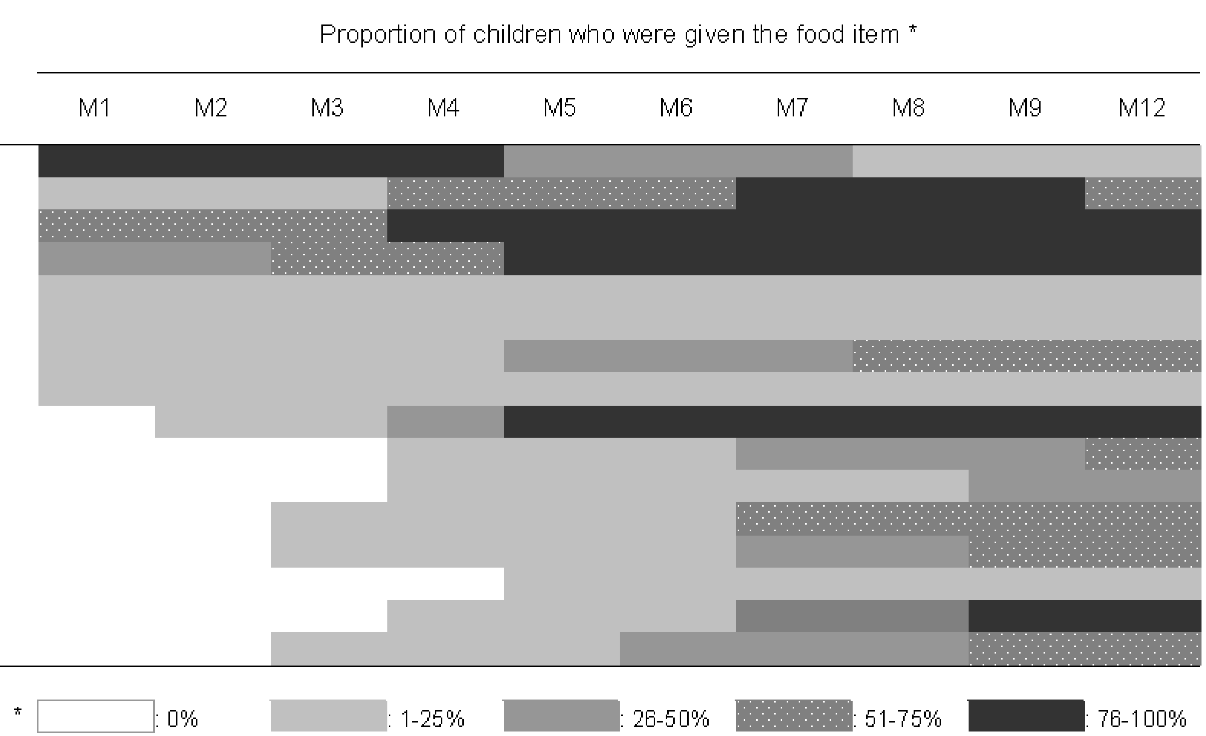

1.00
0.75
0.50
0.25
0.00
Probabaility of being breastfed
0
30
60
90
120
150
180
210
240
270
300
330
360
time in days

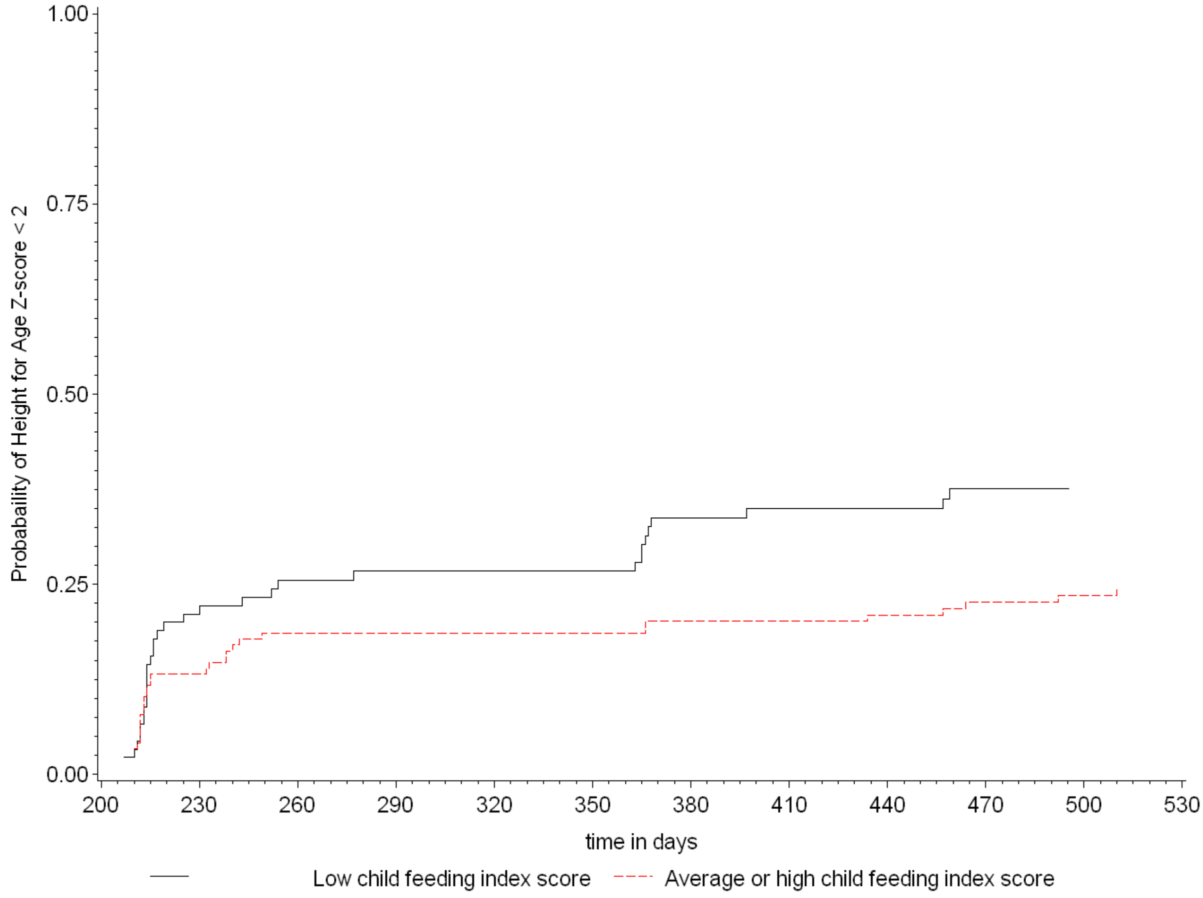
FIGURE 2

	Ever fed the food item (%)	Age that food item was introduced (days)	
		Median	IQR
Breastmilk	100	/	/
Infant formula	74	107	101 - 136
Water (any type)	98	8	6 - 51
Tap water	96	24	6 - 91
Stored water	33	106	24 - 199
Mineral water	47	11	6 - 60
Fruit juice	76	147	79 - 200
Herbal tea	35	52	17 - 195
Baby food	88	135	107 - 167
Vegetables	66	229	198 - 261
Fruits	53	232	197 - 260
Starch, grain, tuber	79	200	197 - 240
Dairy products	67	199	169 - 238
Meat	29	260	243 - 320
Fish	83	200	196 - 232
Eggs	74	199	169 - 257



M1 to M12, age one month to age 12 months

FIGURE 3



Kaplan Meier probability (95%CI) of Height-for-Age *z* score<-2

	Age 9 months	**Age 12 months**	**Age 18 months**
Low child feeding index score at age 6 months	0.26 (0.17,0.34)	0.30 (0.20,0.40)	0.39 (0.29,0.49)
High or average child feeding index score at age 6 months	0.18 (0.12,0.26)	0.20 (0.13,0.27)	0.24 (0.17,0.32)
Overall unadjusted relative risk among children with low compared to children with high or average child feeding index score	1.37 (95% CI: 1.05-1.86), p=0.03		
Overall adjusted relative risk among children with low compared to children with high or average child feeding index score *	1.49 (95% CI: 1.09-2.05), p=0.01		

* adjusted on maternal education, type of housing, birth weight and paediatric HIV status (time dependant variable), Cox regression model