Abstract

Objective: To evaluate the protective role of breastfeeding against diarrhea in children younger than one year of age in the city of Feira de Santana, Brazil, in 2001.

Methods: A cross-sectional study was carried out. Questionnaires were applied to mothers by 104 university students on the national vaccination day in 44 health units (71.0%) selected by simple stratification. 2,319 children were evaluated (24.3% of the estimated population). The prevalence ratio was calculated and considered significant if $p < 0.05$ with a 95% confidence interval.

Results: Diarrhea occurred in 11.6% of the sample, with greater frequency after the sixth month (63.3%). The chance for presenting diarrhea was 64% higher in children younger than six months who were not breastfed vs. breastfed children ($p < 0.02$). When compared to the children who were exclusively breastfed, the chance for presenting diarrhea increased to 82% in children who were not breastfed (95% CI 1.11-3.01).

Conclusions: Breastfeeding and exclusive breastfeeding were a protective factor against diarrhea in the first six months of life.

Introduction

Feeding at the breast is of great relevance to the protection of children from a large number of different infections, above all acute diarrhea. In a meta-analysis performed under the auspices of the WHO and based on data from three continents, it was demonstrated that the risk of death from infectious diseases is 5.8 times greater for infants weaned during the first two months of life when compared with those who are breastfed. This protection reduces as the child grows and during the second year, the level of risk oscillates between 1.6 and 2.1.

Arifeen (2001), by means of a prospective cohort study of 1,677 children, demonstrated that exclusive breastfeeding confers strong protection against death from diarrhea and that predominant breastfeeding or the absence of breastfeeding were associated with a 2.23 times greater risk of dying from infectious diseases and a 3.94 times greater risk of dying from respiratory infections and diarrhea. Similarly, Yoon et al. (1997), in a study performed in the Philippines with 9,942 children less than a year old, evaluated...
the effects of malnutrition and the absence of breastfeeding on the risk of dying from diarrhea and respiratory infections. The absence of breastfeeding had a greater impact upon mortality from diarrhea than on mortality from respiratory infections. Children less than six months old, who were not breastfed or who had been weaned presented an eight to ten times greater risk of dying from diarrhea.

A number of different studies have proven the efficacy of breastfeeding as a practice which helps to avoid diarrhea and deaths related to it. However, it has also been demonstrated that diarrhea is more prevalent under adverse conditions in terms of socio-economic level and basic sanitation. Research performed in Feira de Santana in 1996 showed that a large proportion of the mothers of children less than two years old were adhering to breastfeeding. Taking exclusive breastfeeding of those younger than four months as an example, the level was 46.5% adherence. This is a higher proportion than in the city of Salvador (17.2%), for the Northeastern region (30.2%) and for Brazil as a whole (40.3%). This same population, endures adverse basic sanitary conditions and low levels of education and income associated with an elevated migratory flow; factors which encourage the propagation of infectious and contagious diseases, particularly water-borne ones.

In the face of this situation, peculiar to the city of Feira de Santana (precarious living conditions and high levels of breastfeeding), a cross-sectional study was performed with the objective of evaluating the degree of protection afforded by maternal breastfeeding from acute diarrhoea to children less than one year old. The performance of studies at the population level is of extreme importance to the diagnosis and for Brazil as a whole (40.3%). This same population, endures adverse basic sanitary conditions and low levels of education and income associated with an elevated migratory flow; factors which encourage the propagation of infectious and contagious diseases, particularly water-borne ones.

Methods
This is a cross-sectional study approved by the Commission for Ethics and research at the Universidade Federal da Bahia and performed in the city of Feira de Santana, situated 108 Km from the Bahia state capital, with a population of 450,487 inhabitants. The infant mortality for the year 1999 was 37.37 per thousand live births and the illiteracy rate in 1994 was 37.37 per thousand live births and the illiteracy rate in 1994 was 27.0%. The sewage network is precarious, covering 1/3 of properties with the remainder using a system of septic tanks. Around 95.0% of the population is served by the water supply system. The collection of solid residues is precarious.

Population studied
The population consists of all children from the city of Feira de Santana, less than one year old who had completed that age by the 25th of August 2001, the national vaccination day, and who attended the chosen vaccination centers accompanied by their mothers.

Sample
A sample was calculated that corresponded to 20.0% (1,912) of the estimated target population (9,563) for 2001. The sample design was simple random stratified, a technique which is appropriate to guarantee the inclusion of all sections of the population, because when the vaccination coverage was planned the Health Ministry divided the city into four “commands”, topographical areas represented by contiguous neighborhoods. Vaccination took place at 62 centers (health centers and schools). A simple random sample was selected from each stratum (command). From the first and second, represented by 17 centers each, 12 (70.6%) were selected by drawing lots and from the third and fourth 10 (71.4%) were drawn of the total of 14, making a total of 44 (71.0%) centers out of the total of 62. The questionnaire was filled out for all of the mothers of the children in the target population at the chosen centers.

Research instrument and data collection
The mothers were approached while waiting on line and, after free and informed consent was given, the questionnaires were completed individually. The questions that were prepared were closed with three possible responses: yes, no and don’t know. In order to assess the foodstuffs that were being given to the children, a 24-hour dietary recall was used and, in relation to diarrhea, the question was whether there had been any episode with onset during the preceding 15 days. Data collection was performed by 104 previously trained university students. Two thousand, three hundred and twenty-three (24.3%) mothers responded to the questionnaire; four refused to participate, a number considered to be negligible.

Definition of variables
The two principle variables were breastfeeding (exposure) and acute diarrhea (disease). Children were considered to be breastfed if they suckled. Those who were fed only mother’s milk were considered to be on exclusive breastfeeding and those who were given mother’s milk in association with teas or water were defined as predominantly breastfed. If other liquid, semi-solid or solid foods were offered along with mother’s milk the definition was complemented breastfeeding. Foodstuffs consumed by breastfed children were denominated complementary foods. Children who had stopped breastfeeding were classified as weaned.

The subjective impression of the mothers was used to decide whether or not diarrhea was present as they know the individual intestinal rhythms of their children. It is important to remember that children who are less than a year old have their own intestinal rhythm in which a greater or lesser number of defecations do not alone characterize diarrhea or constipation, but where changes to intestinal habits and the characteristics of stools are more relevant.
**Statistical analysis**

Prevalence ratios were calculated in order to evaluate the associations between variables. Measurements of statistical significance were employed, utilizing the chi-square test and \( p \) value calculations, with paired values \( \leq 0.05 \) being considered significant and 95% confidence intervals being calculated. The software employed was SPSS, version 10.0.

**Results**

The sample studied corresponded to 24.3% (2,319) of the estimated population of children under one year old in the city of Feira de Santana in 2001. Vaccination coverage was 104% since 9,961 children from the age group in question were vaccinated. The total number of children analyzed does not amount to 2,319 for all of the questions since only affirmative or negative responses were included in the calculations; “don’t know” was not considered a valid response.

The prevalence of breastfeeding among those less than one year old was 69.2% (1,603), with a frequency of 93.8% during the first (152/162) and second (225/240) months and 48.6% (101/208) at eleven months. With respect of exclusive breastfeeding, 38.5% (486/1,216) of those six months old or younger were being exclusively breastfed, with a prevalence of 62.1% during the first month and 17.7% during the sixth.

In relation to diarrhea, among those less than a year old, 11.6% (267) had presented an episode during the preceding 15, with a greater concentration of cases (63.3%) during the second semester of life. Of the 267 children who had had diarrhea, 266 mothers gave details of their feeding and it was observed that 38.7% (103) were not being breastfed, 13.9% (37) were on exclusive breastfeeding, 8.7% (23) were being predominantly breastfed and 38.7% (103) had already been given complementary foods.

The dependant variable, diarrhea, was analyzed according to feeding. In those younger than a year it was evaluated in terms of the presence or absence of breastfeeding and the use of complementary foods. In those six months old or younger it was evaluated in terms of the presence or absence of breastfeeding, of exclusive breastfeeding and of predominant breastfeeding. It was observed that, despite the frequency of not breastfed children younger than one year being affected by diarrhea, the force of this association was not statistically significant. However, when this association was evaluated for those \( \leq 6 \) months it reached levels of statistical significance, with a 64.0% (95% CI 1.07-2.51) greater chance of diarrhea among children who were not being breastfed, when compared with those who were (Table 1).

The children who were not being breastfed had an 82.0% (95% CI 1.11-3.01) greater chance of having diarrhea than those being exclusively breastfed. Predominant breastfeeding presented a prevalence ratio greater than 1, however, the 95% confidence interval was not significant. When diarrhea was analyzed in terms of the introduction of complementary foodstuffs, for those less than a year old, there was no difference between the prevalence of those who suckled and used complementary foods and those who were not suckling (Table 1).

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* Predominant breastfeeding was considered as the complementary use of water and tea.
The prevalence of breastfeeding was also analyzed for the 1,199 children six months old or younger in terms of the presence or absence of diarrhea (Figure 1). When the feeding of the 98 children younger than six months old who had diarrhea were analyzed it was found that 73.5% were suckling, 30.6% (30) were being exclusively breastfed, 15.3% (15) were being predominantly breastfed and 27.6% (27) were being given complementary foods. Of the 1,101 who did not present diarrhea, 82.5% were being breastfed, of whom, 39.1% (431) were being exclusively breastfed, 15.2% (167) predominantly breastfed and 28.2% (310) were being given complementary foods, in addition to teas and water. Among the not breastfed children there was an increased rate of occurrence of diarrhea (+9.0%), while among those exclusively breastfed the difference was negative (-8.5%).

Discussion

The wide coverage of the vaccinations and the highly representative sample reinforce the conviction that the results obtained reflect the breastfeeding and diarrhea situation in the city of Feira de Santana, during the data collection period. The results presented here as the prevalence of diarrhea may reflect the incidence of the disease, since the mothers were asked whether their children had had an episode which began during the preceding fifteen days and by definition diarrhea is considered acute when limited to up to two weeks. Barros and Victora (1998) agree with the idea that when the duration of an episode of diarrhea is known, this prevalence data can be converted into an estimate of incidence. Nevertheless, in this study it was decided to consider the measurement of the frequency of diarrhea as prevalence since this is a cross-sectional study, classically used for estimating the prevalence of diseases.

With respect of the definition of diarrhea, that which is most used considers diarrhea to be the presence of three or more evacuations per day of a reduced consistency. However, children younger than one year present variable intestinal rhythms and the presence of a number of defecations per day does not obligatorily indicate diarrhea, particularly during the first three months, during which the defecatory mechanism is triggered by a reflex resulting from anal distension, as with adults, and by the enterogastric reflex, which is very active in this age group. This reflex causes an average frequency of five to seven evacuations per day, immediately after the ingestion of food which decreases with the age of the child. Thus, in this study, information provided by the mother was taken into account in respect of the presence or absence of diarrhea.

Still on the subject of methodological considerations, a fifteen-day recall was employed because, when enquiring about diarrhea, results could be influenced by a recall period of more than two weeks, contributing to a lower number of cases being reported, because episodes could be forgotten and only the most serious ones be reported. The prevalence of diarrhea during the fifteen days which preceded the research was elevated. The rates encountered, however, are lower than those described by the National Demographic and Health Census (1997) which enquired into the occurrence of diarrhea during the fifteen days which preceded the survey, registering a greater prevalence in the Northeastern region (18.0%) and a lesser one for the remaining regions of Brazil (10.0%).

In the analysis of breastfeeding as a factor protecting against diarrhea, a positive association was observed, with statistically significant results, between exclusive breastfeeding and diarrhea, with a dose-response effect in which, the greater the number of times the baby sucked (exclusive breastfeeding), the greater the protection. The simple introduction of water and teas to the child's diet (predominant breastfeeding) was associated with an increased risk of diarrhea.

Feeding exclusively with mother's milk is recognized as the best form of protection from infectious infirmities. In a review of 35 studies published in 14 countries investigating the association between type of infant feeding and morbidity from diarrhea, exclusive maternal breastfeeding was reported to protect against diarrhea in 83% of them. Children who are not breastfed present a greater risk of diarrhea than those who are partially breastfed and these, in turn, have a greater risk of developing diarrhea than do those exclusively breastfed.

The current study observed that the protection afforded by human milk is more evident among younger children.
because when the prevalence of diarrhea was evaluated according to the presence or absence of breastfeeding during the first semester of life, this association attained levels of statistical significance. In contrast, this result was not significant when the entire population of children under one year old was considered.

Newborns and infants, especially during the first six months of life are more vulnerable to infections due to the immaturity of the immunological system and the greater intestinal permeability. Thus, during a critical period of relative immunological incompetence, human milk presents quality attributes in the face of immunobiological needs, protecting against diseases of the digestive tube. The anti-infectious properties of human milk are represented by soluble and cellular components. The soluble components include the immunoglobulins, IgA, IgM, IgD, IgE, with a predominance of IgA, lysozyme, lactoferrin, complementary system components, bioactive peptides, oligosaccharides and lipids. The cellular components include polymorphonuclear phagocytes, lymphocytes, plasmacytes and epithelial cells. It is also worth pointing out the presence of N-linked oligosaccharides, which make the implantation of bifidus flora possible. This in turn, impedes new bacteria that are potential pathogenic agents of diarrhea, such as E. coli among other enterobacteria and are recently arrived in the intestine from colonizing the intestinal tract. The immunological and quality attributes in the face of immunobiological needs, protecting against diseases of the digestive tube. The anti-infectious properties of human milk are represented by soluble and cellular components. The soluble components include the immunoglobulins, IgA, IgM, IgD, IgE, with a predominance of IgA, lysozyme, lactoferrin, complementary system components, bioactive peptides, oligosaccharides and lipids. The cellular components include polymorphonuclear phagocytes, lymphocytes, plasmacytes and epithelial cells. It is also worth pointing out the presence of N-linked oligosaccharides, which make the implantation of bifidus flora possible. This in turn, impedes new bacteria that are potential pathogenic agents of diarrhea, such as E. coli among other enterobacteria and are recently arrived in the intestine from colonizing the intestinal tract.

A number of different studies reveal the impact of weaning on diarrhea episodes. In a case-control study performed in Pelotas, it was demonstrated that the risk of dying from diarrhea increased between twenty and thirty times if weaning occurred at two months of age, in comparison with children who were still being exclusively breastfed. Research into the influence of weaning on the occurrence of persistent diarrhea and malnutrition suggests that breastfeeding should be intensified, particularly in less developed countries in which diarrhea constitutes a public health problem.

In order to determine the prevalence of breastfeeding among children who have never had diarrhea, the type of feeding was evaluated according to the presence or absence of diarrhea, among children younger than six months. The protection afforded by human milk was proven by the relative immunological incompetence, human milk presents quality attributes in the face of immunobiological needs, protecting against diseases of the digestive tube. The anti-infectious properties of human milk are represented by soluble and cellular components. The soluble components include the immunoglobulins, IgA, IgM, IgD, IgE, with a predominance of IgA, lysozyme, lactoferrin, complementary system components, bioactive peptides, oligosaccharides and lipids. The cellular components include polymorphonuclear phagocytes, lymphocytes, plasmacytes and epithelial cells. It is also worth pointing out the presence of N-linked oligosaccharides, which make the implantation of bifidus flora possible. This in turn, impedes new bacteria that are potential pathogenic agents of diarrhea, such as E. coli among other enterobacteria and are recently arrived in the intestine from colonizing the intestinal tract.

In the face of the results exposed, the evident protection afforded to children under six months by breastfeeding and by exclusive breastfeeding against diarrhea is demonstrated. It is possible that adverse sanitary and socio-economic factors may have influenced the results and obfuscate the protection given against diarrhea. Further studies employing multivariate analysis will permit a deeper understanding of this question.

Through this lens, and taking into account that the first year of life is the period of most rapid growth and greatest vulnerability, this study reinforces the importance of maternal breastfeeding, above all as an exclusive feeding practice during the first six months, when the use of water, teas juices or any other foods is absolutely contra-indicated, to the protection of children from acute diarrhea. Finally, the role of the pediatrician is emphasized in the encouragement of maternal breastfeeding as an educator and promoter of infant health.

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References


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