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Cost of infant feeding in infants born in a Mexican city.

Original Article

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SUMMARY.

Objective: The objective of the present study was to compare the effect on morbidity between infants fed mothers milk (breast milk) and artificial milk (formula) during the first six months of life and estimate the cost of medical care for illnesses, incurred by infants of mothers having entitlement to the Mexican Social Security health care system in Mexico.

Methods: This study includes seemingly healthy new born infants with a gestational age of 38 to 40 weeks and a minimum weight of 5.5 pounds, who were followed for six months. The mothers of new infants were interviewed at the Mexican Social Security Institute (IMSS) in Tijuana, Mexico. The variables studied were age, gender, type of feeding, weight, height, morbidity, the number of medical consultations, hospitalization, clinical analysis, the cost of feeding infant foods and the additional cost of foods consumed by the lactating mother.

Results: At the end of the 6th month: 42% continued with breast milk exclusively, 5.5% with breast milk and juices, 15% with breast milk and infant foods. Of the formula fed infants 20% were formula fed, 3%

were given formula and juices, and 12% formula and baby food. Contracting illnesses was positively associated with formula fed infants, (RR= 1.36; 95% CI= 0.99,1.87). The cost of feeding infants exclusively with formula was four times greater than the estimated costs of the supplementary foods consumed by the lactating mothers.

Conclusions: The risk of illness for the breastfed infants and the cost of supplementary foods for the lactating mothers were lower than the formula fed group. (*Rev Biomed 2004; 15:3-9*)

Key words: Breast feeding, infant nutrition, cost, morbidity.

RESUMEN.

Costo de la alimentación infantil en niños nacidos en una ciudad mexicana.

Objetivo. El objetivo del presente estudio fue comparar el efecto sobre la morbilidad entre infantes alimentados con leche materna y con leche artificial (de fórmula) durante los primeros seis meses de vida y estimar el costo de la atención médica por

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enfermedades de infantes cuyas madres eran derechohabientes del sistema de seguridad social en México.

Métodos. Este estudio incluye a recién nacidos aparentemente sanos con una edad gestacional de 38 a 40 semanas y un peso mínimo de 5.5 libras (2.5 kg) a quienes se les dio seguimiento durante seis meses. Las madres de los recién nacidos fueron entrevistadas en el hospital del Instituto Mexicano del Seguro Social (IMSS) en Tijuana, México.

Las variables estudiadas fueron edad, género, tipo de alimentación, peso, altura, morbilidad, número de consultas médicas, hospitalización, análisis clínicos, el costo de la alimentación infantil y el costo adicional de los alimentos consumidos por las madres que daban el pecho.

Resultados. Al final del 6º mes: continuaban con leche materna exclusivamente, 5.5% con leche materna y jugos y 15% con leche materna y alimentos para bebé. El contraer enfermedades estuvo asociado positivamente con los infantes alimentados con fórmula (RR = 1.36; 95% IC= 0.99, 1.87). El costo de alimentar a los infantes exclusivamente con fórmula fue cuatro veces mayor que los costos estimados de la alimentación suplementaria consumida por las madres que amamantaban.

Conclusiones. El riesgo de enfermedad para los infantes que tomaban leche materna y el costo de los alimentos suplementarios para las madres que amamantaban fueron menores que para el grupo alimentado con fórmula. (*Rev Biomed* 2004; 15:3-9)

Palabras clave: Alimentación con leche materna, nutrición infantil, costo, morbilidad.

Introduction.

In 1991, Auberbach *et al.* pointed out that in developing countries, there was a significant difference between lactating practice and health impact, as a result of different criteria used to define exclusively breastfed, partially breastfed, or artificially fed infants (1). In a recent study (2), the WHO working group on the growth reference protocol, examined the associations, among growth patterns and different

durations of exclusive breast-feeding and the types and frequency of complementary foods. The authors did not find any evidence of benefit related to growth and the timing of introduction of complementary foods nor to differential types and frequencies of complementary foods in healthy infants living in environments without major economic constraints. However, there is no evidence indicating the impact of infant feeding on morbidity in populations in poor environments.

On the other hand, Ruel MT and Menon P (2002) observed in Latin America, that feeding practices were strongly and significantly associated with child height-for-age Z-scores. In addition they found that better feeding practices were more important for children of lower socioeconomic status (3).

The demonstrated benefits of mother's milk are diverse, including a stronger bonding between the mother and infant, improved neurological development, a decrease in infections and protection against chronic illness (4-11). Some authors have also observed higher cost benefits from mothers milk over artificial milk (12-14). Howie *et al.* (12) reported infants feeding habits and morbidity during the first 24 months. They found, after adjusting for variables that influenced morbidity, that infants breastfed during the first 13+ weeks of life had fewer gastrointestinal problems than their formula fed counterparts. This was observed independently of the inclusion of supplements given to the infants. These authors also found that benefits, including less hospitalization, were maintained for one year following weaning. They reported that in urban areas of developed countries, the risk of death from viral infections was four times lower in infants that were breastfed. The same results had been observed from the hospitalization rates. Additionally, when a respiratory infection developed in the breast fed infants, the infection was less severe than that in formula fed infants (12).

A greater incidence of type 1 diabetes in children has been reported in infants fed with artificial milk; some projections suggest that the risk attributed to the artificial feeding oscillates from 2% to 26% (10). Riordan (14), indicates that an additional annual cost exists for health care when medical treatment is

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required for illnesses in non breast fed infants. The estimation of the extra annual health care cost incurred in the United States as a result of artificial feeding attributed to diarrhea, respiratory, sinus virus infections, insulin-dependent diabetes mellitus, and otitis media has been one billion dollars (14). The feeding costs and related medical attention required by infants fed with artificial milk have created additional economical burdens to the poverty experienced by the majority of developing countries (1). The northern Mexico border region is characterized for its high population of immigrants, where many women become part of the work force in the Maquiladora Industry and concurrently acquire cultural influences from the United States. These factors have influenced an increase in the artificial feeding of their infants (15). The objective of the present study was to compare the effect on morbidity between infants fed mother's milk (breast milk) and artificial milk (formula) during the first six months of life and estimate the cost of medical care for illnesses, incurred by infants of mothers entitled to the Mexican Social Security health care system in Tijuana.

METHODOLOGY.

This is a prospective study including seemingly healthy new born infants with a gestational age of 38 to 40 weeks and a minimum weight of 5.5 pounds (2500 grams). In 1995, mothers with new infants were interviewed at the Mexican Social Security Institute (IMSS) in Tijuana, Baja California, Mexico. All infants with a diagnosis of congenital cardiopathology, hydrocephaly, HIV virus, pyloric stenosis or atresia, renal or hepatic insufficiency, permanent growth and development impairment or undiagnosed questionable pathology, alcoholic or drug addicted parents were excluded from the study. The variables of this study included age, gender, type of feeding, weight, height, morbidity, the number of medical consultations, hospitalization, clinical analyses, the cost of infant foods, and the additional cost of foods consumed by the lactating mother.

The project was approved by the Instituto de

Nutrición de Baja California Research Committee (June 20, 1995). After describing the study to the mothers, some basic information and written consent was obtained from them. The infant's follow-up was performed at the outpatient clinic of the Mexican Institute of Social Security (IMSS) which the participating parents attended every month for six months following their infant's birth. The monthly follow-up clinical visit was conducted and a record kept of: The child's age, weight, height, type of feeding, any illnesses, and feeding costs incurred for the infant and mother. All of the recorded information was processed in the computerized statistics program Windows SSPS v. 8.0.

The cost of baby food was estimated at \$ 1.20 dollars (12.00 Mexican pesos) for a 300g (10 ounces) box of cereal and the cost of juice at \$ 1.00 dollar (9.00 Mexican pesos) for eight ounces.

During the first and second months baby food consumption was estimated at 0.5 oz (fifteen grams) of cereal per day; during the third and fourth months, the consumption was estimated at 20 grams per day and by the fifth and sixth months the consumption estimated was twenty five to thirty grams per day.

In order to estimate the cost of feeding the lactating mother, the mother's caloric requirements for lactation during the first six months were considered according to the recommended daily allowances (10^a Ed., 1989). These guides recommend an additional 500 kcal / day. It was established that dietary supplements should contribute to the total diet with 15 grams of protein, 500 mg of retinol equivalent, 3mg of alpha-tocopherol, and 25 mg of vitamin C.

This supplemental suggestion was made according to the recommended consumption for Mexico, and in addition included 1 cup of milk (240ml), 1 cup of orange juice, 2 corn tortillas (30 grams each), 1 cup of mixed vegetables, and 1/2 a cup of cooked beans, providing approximately 559 calories, 26g of protein, 507g of calcium, 383 mg of Vitamin A, 3.3 mg of vitamin E and 190 mg of vitamin C. The total cost for this nutrition corresponded to approximately \$ 0.40 dollars (\$ 4.05 Mexican pesos) per day.

To estimate the cost incurred for a medical visit, the cost described by Arredondo (14) was used as calculated for healthcare recipients of the Social Security Mexican Institute (I.M.S.S.). Arredondo established an average patient cost per medical visit of \$ 5.20 dollars (\$ 47.84 Mexican pesos) including the cost for transportation, laboratory and X rays, medicine obtained in pharmacies, and other private consultations.

The normality and deviations of the variable studies were examined by descriptive statistics. To obtain the difference in height and weight measurements, the t Student test for independent samples was used. To show the differences in months the ANOVA variance analysis was used. To observe the association between the type of feeding and the morbidity, the chi-squared with Fisher's correction test was used. The relative risk of incidental illnesses between exclusively breast fed infants and formula fed ones was also calculated.

RESULTS.

A total of 245 mother/infant pairs were contacted and 163 qualified to participate. At birth 80 (49%), were breastfed, 33 (20%) were given artificial milk, and 50 (31%), received mixed feedings of maternal milk and juices. At one month of age 74 children (45.4% of all participants) were breastfed

exclusively (92.5% of those that had initiated with breast feeding), the 32 that were exclusively formula fed at birth were still formula fed. During the fourth and fifth months the incidence of exclusive breast-feeding decreased to 72, but a subgroup of breastfed and solids (baby foods) occurred, and subsequently did not present any feeding modifications until the end of the six months (figure 1). The differences in height and weight at birth, and again at six months, were also noted according to type of feeding (Table 1). Figure 2 shows the number of ill children during the first six months of life relative to feeding. At six months of age, 63% of the children were exclusively formula fed and 22% of the children were breastfed. The percentage of breast fed children that presented illnesses on two or three occasions, compared to the ones that were fed with formula was 16% and 4% respectively, and from children that were breast-fed was 4% and 0.9%, respectively. The most common infections were upper respiratory tract infections, gastrointestinal illness, and superficial mycosis.

Table 2 shows the morbidity relative risk presented between the infants who were formula fed compared to those that were breastfed. These results were independent of kind and time of foods introduced. Monthly cost of supplemental foods according to infant feeding is shown in Table 3. Results showed that four infants could be breastfed

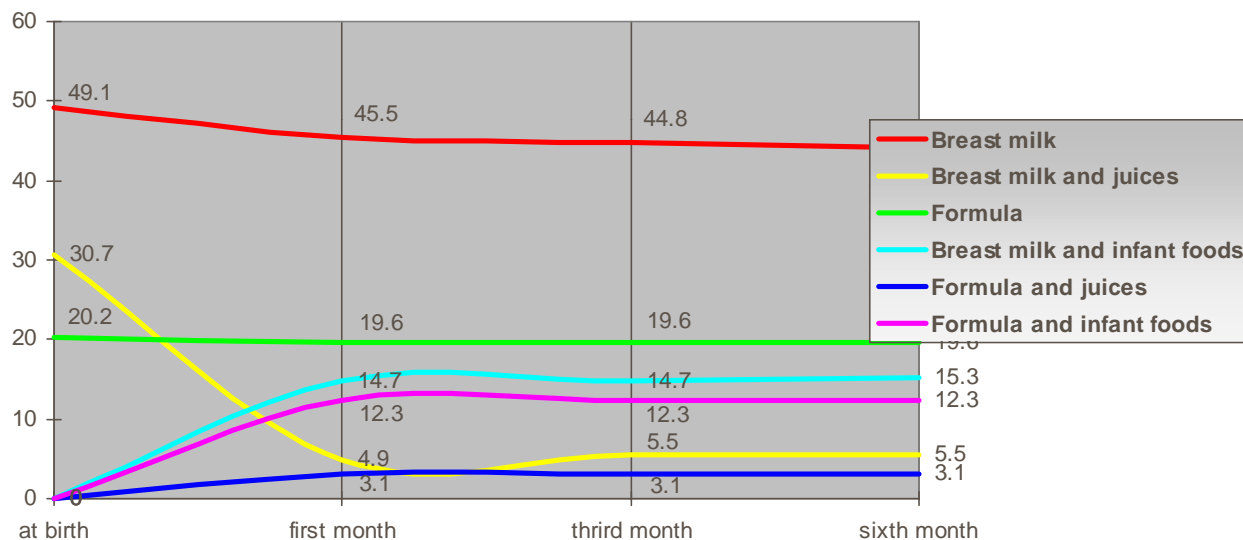


Figure 1.- Evolution of infant feeding practices.

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Table 1
Differences in height and weight (mean \pm sd) at birth and at six months according to type of feeding.

	Type of Feeding		P*
	Breast milk	Formula	
Weight at birth (kg)	3239 \pm 415	3339 \pm 594	0.21
Weight at six months (kg)	7 605 \pm 886	7544 \pm 981	0.68
Height at birth (cm)	50 \pm 2.2	51 \pm 3.4	0.09
Height at six months (cm)	67 \pm 2.7	67.1 \pm 2.7	0.81

* student t-test

for the cost of feeding one formula fed infant.

The infants fed with formula became ill 2.3 times more often than the infants that were breastfed. The total cost incurred during the six months for medical attention for all the exclusively breastfed (106) infants was \$ 140.00 dollars, or \$ 1.32 dollars per infant, in comparison to the formula fed infants, amounting to \$3.06 dollars/ infant. The approximate cost per sick infant between breastfed and formula fed infants was \$ 6.70 dollars and \$ 8.60 (this does not include the cost of medicines). The average cost estimated for medicine given exclusively to breastfed infants was \$18.00 dollars (\$177.00 Mexican pesos) compared to the formula fed infants \$ 19.00 dollars (\$183.00 Mexican pesos).

DISCUSSION.

It was observed that regardless of the inclusion of juices and baby food the exclusively breastfed infants experienced fewer episodes of illness than the infants who were formula fed, RR 1.36 (95% CI= 0.99, 1.87). Additionally, the formula fed infants experienced more illnesses throughout the six-month period. These results are consistent with other studies (12,17), which found differences in the incidence of morbidity and mortality and diarrhea according to the type of infant feeding. In these studies, the lowest morbidity and mortality were observed in infants that were exclusively breastfed, and the highest in infants that were artificially fed.

48% of the mothers initiated breastfeeding, compared to 88% among women in New Zealand.

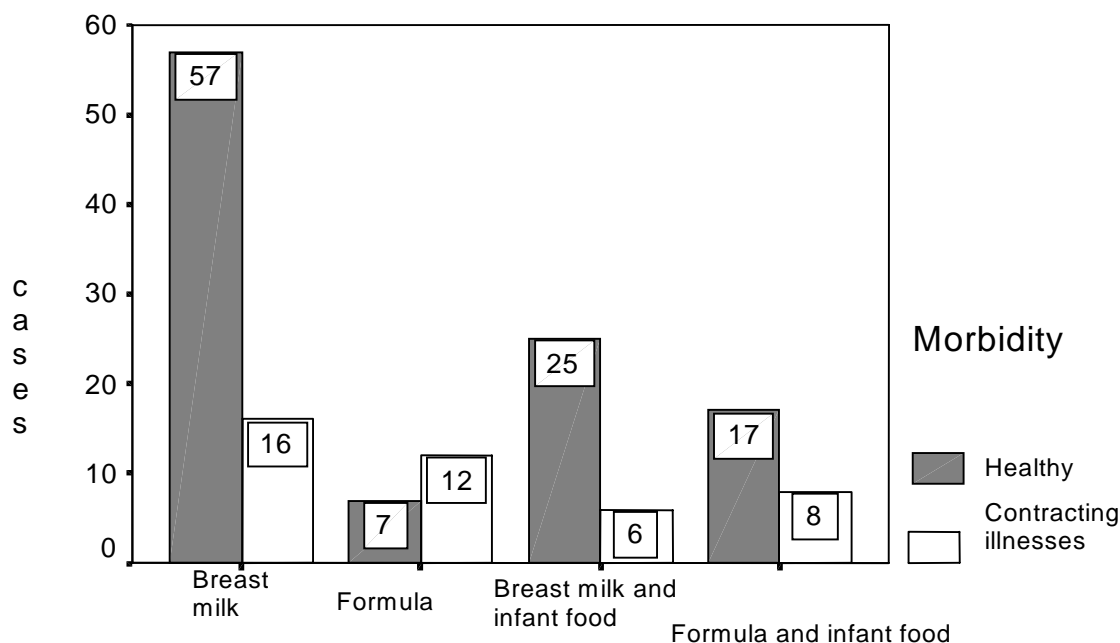


Figure 2.- Association between feeding infant practices and morbidity during six months.

Table 2
Morbidity and relative risk of morbidity between infants who were formula fed and breast-fed.

Type of Feeding	Morbidity N (%)				Relative Risk		
	Healthy	Contracting illnesses	χ^2	P*	RR	IC	95%
Breastfed	85 (80)	21 (20)	4.59	0.038	0.62	0.41 -	0.94
Formula-fed	37 (65)	20 (35)			1.36	0.99 -	1.87

* Fisher correction.

White mothers (18), and 47% of women after receiving a breastfeeding educational program at an urban medical center for health care providers in South Carolina (19), the cost estimates per medical visit (transportation, lab analysis or visits outside of I.M.S.S. (Mexican Healthcare Institute)), did not include the fact that the average cost of medicine at private pharmacies was \$ 18.00 dollars. The families without healthcare benefits in Mexico account for approximately 30-40% of the whole population. Additionally, the cost of formula was four times greater than the estimated cost of extra food consumed by the lactating mother during the six-month period. The families of the infants that were formula fed and given canned juices had the highest food spending costs. In a study realized in Hawaii the comparative cost of feedings with formula was found to be \$ 119.14 dollars compared to \$ 49.16 dollars spent for additional low cost food consumed by the lactating mother (16).

In our study there were no statistical differences in weight and length between different infant feeding practices (Table 1). This data is not consistent with other findings, where it has been reported that

exclusively breast fed infants have a significant gain in weight in the first month of life (17).

In the present study no significant morbidity differences were observed between exclusively breastfed and partially breastfed infants. However, Howie et al (10) observed that breastfed infants during the first 13 weeks or more presented less gastrointestinal pathology than formula fed infants. This observation was independent of the inclusion of supplements or solids before the age of 13 weeks. The most frequently described illnesses in their study were upper respiratory tract infections, with gastrointestinal disease in second place, and otitis media and mycosis in third. They also reported a higher incidence of gastrointestinal diseases during spring and summer.

In our study, breastfed infants presented the same weight and height development as formula fed infants. However, the risk of contracting illness in the first six months of life for infants fed with formula was higher. The results suggest that in a population without entitlement to social security benefits in the North of Mexico and, specifically in Tijuana, infant feeding with formula has a higher impact on the morbidity of infants during the first six months of life. In addition, the costs incurred from the resulting medical expenses might contribute to the overall deterioration of the economy for low-income families.

Nutritional education programs in public institutions and private hospitals need to be strengthened, including more prenatal and post natal education for mothers. Additional programs are also essential to promote and evaluate compliance of recommended feeding norms, especially during the first

Table 3
Mean cost of type of feeding.

Type of Feeding	n	Mean monthly cost \pm DE
Breastfeeding	72	121 \pm 0
Formula	32	522 \pm 0
Breastfeeding and juices	9	321 \pm 7.5
Formula and juices	5	741 \pm 0
Breastfeeding and infant food	25	268 \pm 8
Formula and infant food	20	671 \pm 0

six months of life, and to establish immediate action when a decrease in maternal lactation practice is detected. Another application of the present study results suggests the establishment of regulations in maquiladoras and other businesses to encourage and support adequate lactation practices for working mothers. The provision of on site child day care is an ideal way to accomplish this.

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