

Infant feeding pattern and hospitalization due to infection

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ABSTRACT

Objectives: This case-control study was carried out to evaluate the effects of infant feeding pattern on hospital admission due to infection. **Patients and Methods:** The study has included 498 infants (320 males and 178 females) who attended primary health centers for routine check up and vaccination, and 250 infants admitted to Basrah Maternity and children Hospital (164 males and 86 females), from the first of March 2008 till the end of June 2008, their ages ranged from 1–12 months. Selected socio-demographic variables were evaluated in addition to child birth variables, feeding pattern, cause of admission, duration of hospitalization and outcome. **Results:** The study revealed a significantly higher percentage of admissions due to diarrhea and respiratory tract infection among infants peon bottle feeding (23.8%, 15.6%) and partial breast feeding (16.4%, 11.6%), compared to those on exclusive (2% and 1.2%) and predominant breast feeding (11.2% and 10%), P value <0.001 and <0.01 respectively. The effects of feeding pattern on the outcome have shown that there is a significant increase in the mortality among bottle fed infants (4.8%) while none of admitted patients on exclusive breastfeeding died, P value <0.01. In addition, there is a significant association between feeding pattern and duration of hospitalization (P value<0.05), history of previous hospitalization (P value <0.05), mother age (P value<0.05), mother education (P value <0.001), and mother and father employment, (P value <0.001 and 0.05 respectively). **Conclusions:** Feeding pattern among admitted cases with infections is significantly associated with formula feeding and partial breast feeding compared to exclusive and predominant breast feeding. (MJBU,30,2: 2012, Page 75-84)

تغذية الرضع وأحتمال تعرضهم للإدخال للمستشفى بسبب الخمج

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الهدف: التعرف على الترابط بين أنماط مختلفة لتغذية الأطفال في عمر السنة الأولى والإدخال في المستشفى بسبب الخمج. **الطريقة:** ارتكزت هذه الدراسة على تحليل المعطيات التي أستمدت من المرضى الذين يراجعون مراكز الرعاية الصحية الأولية في البصرة لغرض اللقاحات حيث كان عددهم خلال فترة الدراسة 498 طفل (320 ذكر و 178 أنثى) ومن المرضى الراقدين في مستشفى البصرة للولادة والأطفال وكان عددهم 250 (164 ذكر و 86 أنثى) من بداية شهر آذار 2008 الى نهاية شهر حزيران 2008 وكانت أعمارهم تتراوح من 1 و 12 شهرا. تضمنت الدراسة أسئلة عن عوامل بيئية واجتماعية محددة، مثل العمر، الجنس، السكن، عمر الأم، عمر الأب، وظيفة الأب وإلام والمستوى التعليمي للام والأب، عوامل تتعلق بولادة الطفل، نمط الرضاعة، وسبب الرقود ومدة الرقود في المستشفى وهل أدخل المريض الى المستشفى سابقا. تم قياس الطول والوزن بالطرق القياسية لجميع الأطفال. تم إدخال وتحليل هذه القياسات حسب جداول خاصة تابعة لمنظمة الصحة العالمية وتم حساب الانحراف المعياري لكل من الوزن بالنسبة للطول. النتائج: كانت نسبة دخول المستشفى بسبب الإسهال والتهابات التنفسية هي أكثر في المرضى مع عدم الرضاعة من الثدي (23.8%، 15.6%) و الرضاعة الجزئية من الثدي (16.4%، 11.6%) منها في غلبة الرضاعة من الثدي (11.2%، 10%) واقتصار الرضاعة من الثدي (2%، 1.2%) وكانت قيمة الاحتمال أقل من 0.001 و 0.01 على التوالي. بالإضافة الى ذلك تأثير نمط التغذية على تطور حالة المريض حيث وجدت نسبة وفيات في عدم الرضاعة من الثدي أكثر من الرضاعة من الثدي وكانت قيمة الاحتمالية هي أقل من 0.01. أثبتت الدراسة وجود علاقة معتمد بها إحصائيا بين نمط الرضاعة وطول مدة رقاد المرضى في المستشفى وكانت نسبة الاحتمالية أقل من 0.05، دخول سابق الى المستشفى وكانت نسبة الاحتمالية اقل من 0.001، عمر الأم وكانت اقل من 0.05، المستوى التعليمي للام وكانت اقل من 0.001، الأب الموظف والأم الموظفة وكانت أقل من (0.05 و 0.001) على التوالي. الاستنتاجات: أظهرت الدراسة وجود علاقة معتمد بها إحصائيا بين المرضى الراقدين في المستشفى من ناحية عدم الرضاعة من الثدي مع الرضاعة الجزئية من الثدي بالمقارنة مع غلبة الرضاعة من الثدي واقتصار الرضاعة من الثدي.

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INTRODUCTION

Breast feeding is strongly recommended during the first months of life as it contains all the newborns nutritional needs and provides immunological protection which is important in reducing the frequency of infections.^[1] Breast-feeding is beneficial in preventing gastrointestinal and, to a lesser extent, respiratory infections in both developing and developed countries. In addition, it has been recognized that protection, provided through breast milk, against some infections may extend well beyond weaning.^[2] Protection from mortality by breastfeeding is greatest for the youngest infants.^[3] Globally, as many as 1.45 million lives (117 million years of life) are lost due to suboptimal breastfeeding in developing countries.^[4] Relatively few risks are responsible for a large percentage of deaths and morbidity in developing countries. These risks generally act by increasing the incidence or severity of infectious diseases. In combination, childhood underweight, micronutrient deficiencies and suboptimal breastfeeding cause 7% of deaths and 10% of total disease burden. In developing countries, only 24–32% of infants are exclusively breastfed at 6 months on average, and these percentages are much lower in developed countries.^[5] The risk of death is similar for infants who are predominantly breastfed and those who are exclusively breastfed suggesting that in settings where rates of predominant breastfeeding are already high, promotion efforts should focus on sustaining these high rates rather than on attempting to achieve a shift from predominant breastfeeding to exclusive breastfeeding.^[6] This case–control study was carried out to look for feeding pattern among infants hospitalized for infection and compare it with healthy controls and study the association between feeding pattern and certain variables like type of infection, duration of hospitalization and outcome.

SUBJECTS AND METHODS

A case–control study has been carried out on infants (beyond the neonatal period) over the period from the first of March 2008 till the end of June 2008. Infants. A total of 250 patients

who have been admitted to pediatric wards at Basrah Maternity and Children hospital, were included in the study. The control group included a total of 498 age and sex matched infants seen 3 primary health centers in the center of Basrah (AL-Basrah, AL-Razi and AL-Ashar) for checkup and routine immunizations during the study period were recruited. Cases were terms, singletons, aged from 1-12 months admitted with infection. Infants with congenital anomalies, underlying diseases or risk factors that would either affect the feeding methods or make the infant prone for frequent hospitalizations, like immune deficiency, and congenital heart diseases were excluded. Controls were healthy infants having the same inclusion criteria of cases. Data were collected through a special questionnaire designed for the purpose of the study. Information obtained for hospitalized patients included: age, gender, residence, birth order, mode of delivery, place of delivery, cause(s) of admission, any previous hospitalization (including neonatal period), age at previous hospitalization and diagnosis of illness in the previous hospitalization. In addition, the duration of current hospitalization, the final diagnosis and the outcome on discharge from hospital were recorded. Parental data included age, education, employment, smoking. Maternal and paternal education were coded as low (primary school or less), and high (at least 1 year of intermediate schooling or higher). Information obtained from control group were the same that of patients concerning socio-demographic data, parental data, feeding history and past history. All children were weighed, wearing light clothing, on a calibrated mechanical or electronic scale. The length measured using stadiometer. The questionnaire was filled and examination done by the same person (first author). Weight-for-height Z-scores were assessed as recommended by WHO/NCHS reference curves.^[7]

WHO classification was used to define the method of feeding:^[6,8]

- **Exclusive breastfeeding:**

Giving an infant no food or drink, not even water, other than breast milk except for drops or syrup of vitamins, mineral supplements, or medicines.

- **Predominant breastfeeding:**

The infant mostly receives breast milk but is also occasionally given other liquids, including water and/ small amounts of ritual or other foods.

- **Partially breastfed:**

The infant is given some breast feeds and some artificial feeds, either milk or cereal, or other food or water.

- **Bottle feeding:**

The infant is feeding from a bottle, regardless of its contents, including expressed breast milk.

Data entry and analysis were done using the SPSS program, version 11. Chi square was measured and P-value of less than 0.05 was

considered as statistically significant. Logistic regression analysis was done for all variables to look for any association of these variables with infants feeding pattern and admission to the hospital and odd ratio (OR) was assessed.

RESULTS

A total of 250 infants; were included in the study. One hundred sixty four (65.6%) were males and 86 (34.4%) were females their ages ranged from 1-12 months (means \pm SD was 5.49 ± 3.08). There was no significant difference between cases and control regarding age and sex, P value > 0.05 , (**Table-1**). Maternal age has ranged from 16 to 43 years, with a mean age of 24.21 ± 4.55 years. Among cases, 22 (8.8%) of the infants their mothers were below 20 years of age, compared to 23 (4.62%) in the control group, P value > 0.05 . Concerning maternal education, there was no statistically significant difference between cases and controls. A similar result was obtained for father education, P value > 0.05 , (**Table-1**).

Table 1. Selected socio-demographic characters of studied cases & controls

Variables		Cases		Control		P value
		No.	%	No.	%	
Age (months)	1-3	67	26.8	130	26.1	> 0.05
	4-6	112	44.8	233	46.8	
	7-12	71	28.4	135	27.1	
Sex	Male	164	65.6	320	64.3	> 0.05
	Female	86	34.4	178	35.8	
Mother age(years)	< 20	22	8.8	23	4.6	> 0.05
	21 – 29	215	86.0	461	92.6	
	≥30	13	5.2	14	2.8	
Mother education	Low	192	76.8	323	64.9	> 0.05
	High	58	23.2	175	35.1	
Father age (years)	< 20	24	9.6	58	11.6	> 0.05
	21 – 29	131	52.4	250	50.2	
	≥30	95	38.0	190	38.2	
Father education	Low	136	54.4	227	45.6	> 0.05
	High	114	45.6	271	54.4	
Birth order	1 st	80	32.0	92	18.5	> 0.05
	2 nd	102	40.8	235	47.2	
	≥ 3 rd	68	27.2	171	34.3	
Mother smoking	Yes	5	2.0	12	2.4	> 0.05
	No	245	98.0	486	97.6	
Father smoking	Yes	193	77.2	379	76.1	> 0.05
	No	57	22.8	119	23.9	
Mother employment	Yes	42	16.8	85	17.1	> 0.05
	No	208	83.2	413	82.9	
Father employment	Yes	218	87.2	430	86.3	> 0.05
	No	32	12.8	68	13.7	
Total		250	100	498	100	

Concerning the causes of hospitalization; diarrhea was the commonest cause in 132(52.8%) followed by acute respiratory tract infection in 96(38.4%), UTI in 10(4%), sepsis 6(2.4%), meningitis 4(1.6%) and myocarditis in 2(0.8%). A statistically significant number of

infants with diarrhea and respiratory tract infection were on partial and bottle feeding compared to exclusive and predominant breast feeding, P value<0.001 and <0.01 respectively, **Table-2.**

Table 2. Distribution of cases in relation to type of disease and feeding pattern

Diseases	Feeding pattern				P- value
	Exclusive No. (%)	Predominant No. (%)	Partial No. (%)	Bottle No. (%)	
Diarrhea	5(3.33)	28 (50.90)	41 (54.67)	58 (55.24)	< 0.001
Respiratory tract infection	3(20)	25 (45.46)	29 (38.67)	39 (37.14)	< 0.05
Urinary tract Infection	6(40)	1 (1.82)	2 (2.67)	1 (0.95)	< 0.01
Myocarditis	0	0	1 (1.33)	1 (0.95)	
Encephalitis/meningitis	1(6.67)	0	1 (1.33)	2 (1.90)	
Sepsis	0	1(1.82)	1 (1.33)	4 (3.80)	
Total	15	55	75	105	

X² was measured for each row separately

While urinary tract infection was significantly higher among infants on exclusive breast feeding. The feeding pattern among cases and controls were assessed and it was found that exclusive and predominant breastfeeding were statistically significantly lower among cases compared to the control group, (OR were 3.977 and 7.246 respectively), **Table-3**.

Table 3. Distribution of cases and controls according to their feeding pattern and nutritional status.

Variable	Cases		Control		OR
	No.	%	No.	%	
Feeding pattern					
Exclusive	15	6.0	50	10.0	3.977*
Predominant	55	22.0	334	67.1	7.246*
Partial	75	30.0	26	5.2	0.414
Bottle	105	42.0	88	17.7	0.838
Total	250	100	498	100	
Nutritional Status					
≥ 2SD	22	8.8	41	8.2	1.299
1SD to >-1SD	129	51.6	315	63.3	1.702*
-1SD to -2SD	99	39.6	142	28.5	1.435*
Total	250	100	498	100	

*P value < 0.05

The same table shows that mild malnutrition was significantly higher among cases compared to control group (OR 1.435). A significantly higher number of infants with history of neonatal hospitalization were on bottle feeding compared to those on exclusive breast feeding,

P value <0.01. The same result was obtained for previous hospitalization P<0.05. In addition the duration of hospitalization was significantly longer among infants on bottle feeding compared to exclusive breast feeding, P-value <0.05, (**Table-4**).

Table 4. Infant feeding patterns among hospitalized infants

Variables		Infant feeding pattern				P value
		Exclusive No. (%)	Predominant	Partial	Bottle	
Neonatal hospitalization	Yes	1(6.7)	4 (7.27)	19(25.33)	29(27.62)	< 0.01
	No	14 (93.3)	51(92.73)	56(74.67)	76(72.38)	
Total	250	15 (100)	55	75	105	
Previous hospitalization (beyond neonatal period)	Yes	1(6.7)	9(16.36)	14(18.67)	21(20)	< 0.05
	No	14(93.3)	46(83.64)	61(81.33)	84(80)	
Total	250	15	55	75	105	
Duration of current hospitalization (days)*	1 – 3	9(60)	31(56.36)	38(50.67)	41(39.04)	< 0.05
	4 – 6	5(33.3)	20(36.36)	31(41.33)	45(42.86)	
	≥ 7	1(6.7)	4 (7.27)	6 (8)	19(18.1)	
Total		15	55	75	105	
Outcome*	Improved	14 (93.3)	45(81.82)	52(69.33)	75(71.43)	< 0.01
	Discharge on parent responsibility	1(6.7)	9 (16.36)	21(28)	25(23.81)	
	Death	None	1(1.82)	2(2.67)	5(4.76)	
Total		15	55	75	105	

The same table shows that all infants on exclusive breast feeding improved and discharged well, compared to 75(71.42%) on bottle feeding, In addition the percentage of infants who died has increased significantly as the frequency of breast feeding decreases, P value <0.01. (Table-5), reveals a significant association between feeding pattern and mother age, P value <0.05, and mother education,

where a significantly higher percentage of mothers of low education were giving their infants bottle feeding and partial breast feeding compared to mothers with higher education, P value <0.001. In addition a significantly higher percent of infants of unemployed mothers (housewives) were partial breast feeding and bottle feeding compared to employed mothers, P<0.001.

Table 5. Distribution of different variables in relation to feeding pattern among hospitalized infants

Variables		Feeding pattern								P value
		Exclusive (No. 15)		Predominant (No. 55)		Partial (No. 75)		Bottle (No. 105)		
		No.	%	No.	%	No.	%	No.	%	
Sex	Male (No.164)	9	60	36	65.45	56	74.67	63	60	> 0.05
	Female (No.86)	6	40	19	34.55	19	25.33	42	40	
Birth order	1st (No.80)	3	20	17	30.91	24	32	36	34.29	<0.01
	2 nd (No.102)	5	33.33	21	38.18	30	40	46	43.81	
	≥ 3 rd (No.68)	7	46.67	17	30.91	21	28	23	20.90	
Mode of delivery	C/S (No.22)	1	6.67	1	1.82	7	9.33	13	12.38	<0.05
	Vaginal (No.228)	14	93.33	54	98.18	68	90.67	92	87.62	
*Mother age. (Yrs.)	< 20 (No.22)	5	33.33	5	9.1	4	5.33	8	7.62	< 0.05
	21 – 29 (No.215)	10	66.67	45	81.82	67	89.33	93	88.57	
	≥ 30 (No.13)	0	0	5	9.1	4	5.33	4	3.81	
Mother education	Low (No.192)	6	40	35	63.64	61	81.33	90	85.71	< 0.001
	High (No.58)	9	60	20	36.36	14	18.67	15	14.29	
Mother employment	Yes (No.42)	8	53.33	14	25.45	8	10.67	12	11.43	< 0.001
	No (No.208)	7	46.67	41	74.55	67	89.33	93	88.57	
Father education	Low (No.136)	6	40	25	45.45	45	60	60	57.14	< 0.05
	High (No.114)	9	60	30	54.55	30	40	45	42.86	
Father employment	Yes (No. 218)	15	100	31	56.37	71	94.67	101	96.1	< 0.05
	No (No. 32)	0	0	24	43.63	4	5.33	4	3.9	

The same results were obtained for father's education (P-value <0.05) and father's employment (P value <0.05). Logistic regression analysis concerning feeding pattern

among admitted cases has revealed a significant association with bottle feeding and partial breast feeding compared to exclusive and predominant breast feeding, P value<0.001, (Table-6).

Table 6. Adjusted odd's ratio, and 95% confidence interval for infant hospitalized with four different methods of feeding

Feeding method*	OR	95% CI	P value
Predominant vs bottle-feeding	0.138	0.092 – 0.206	< 0.001
Predominant vs partial	0.57	0.034 – 0.097	< 0.001
Exclusive vs partial	0.104	0.05 – 0.216	< 0.001
Exclusive vs bottle-feeding	0.251	0.132 – 0.478	< 0.001

* Dependent factor was hospitalized infants while independent factors were feeding pattern

DISCUSSION

Infectious diseases are leading causes of morbidity and hospitalization for infants and children. During infancy, breast-feeding protects against infectious diseases, particularly respiratory infections, gastrointestinal infections, and otitis media.^[9] Around 6.0% of infants admitted to the hospital were on exclusive breast feeding compared to 10.04% on exclusive breast feeding in the control group, which is similar to the percentage reported from previous WHO studies which has revealed that only 5-10% of infants in Iraq were exclusively breast fed,^[10] while bottle feeding accounts for the higher percentage among admitted infants to the hospital reaching 42.0% from the total cases, in contrast to the control group 17.67%. In this study, maternal education shows a significant association with feeding pattern among hospitalized infants. This result is similar to that reported by AL-Awadi et al in Kuwait^[11] but in contrast to result of study by Talayero, et al in Spain.^[12] Many studies didn't reveal a significant association between maternal age and feeding pattern.^[12-14] In this study a significantly higher percent of young mothers of hospitalized infant's have fed their babies exclusive breast feeding, while none of mothers older than 30 years were feeding their babies exclusive breast feeding. On the other hand father age did not appear to be a significant factor as in other studies.^[11-14] Although the current study didn't reveal a significant difference between parental smoking among cases and controls. It was reported that maternal and family smoking increases the frequency of hospitalization by breastfeeding exposure and stratified on maternal smoking. Although the relationship is not entirely clear, some studies have not found an association.^[12,14] Environmental tobacco smoke exposure was demonstrated to have an effect on frequency of infections during infancy.^[15] The study revealed that a significantly higher percent of infants of working mothers were on exclusive and

predominant breastfeeding, this in contrast with a result of Shiva et al in Iran,^[13] this may indirectly reflect that employed mothers are of higher education and better oriented about the advantage of breast feeding. In addition, father employment, appears to be significantly associated with the feeding pattern. This result similar to study done by Barclay, et al.^[16,17] Low family income has a significant association with interruption of breastfeeding.^[17] Conditions associated with infant's birth may affect feeding pattern, in this study mode of delivery demonstrated a significant association with the feeding pattern, this is in agreement to Shiva et al in Iran^[13] which has reported a significant association of caesarean delivery with feeding pattern. While in other studies in developed countries didn't show a significant correlation.^[12,14] Birth order had a significant effect on the feeding pattern among hospitalized infants in this study. Rakhshani had reported that birth order is an important factor for continuation of breastfeeding^[18] but AL-Awadi, et al in Al-kuwait didn't report such finding.^[11] More than half of admissions were to the diarrheal diseases followed by respiratory tract infection and most of infants were either on partial breastfeeding or bottle fed infants. The findings of protective effect of breast feeding against hospitalizations for diarrhea and respiratory infections is found in this study. This is in agreement with other studies.^[9,19] Karmer et al have noted that although breast feeding protect against diarrhea, breast feeding did not protect against respiratory tract infections or hospitalization due to infection.^[20] There is a large body of data describing how the immunologic properties of breast milk are likely to protect against infection in the infant. In addition, infection may be attributable to contamination of bottles, teats, milk, and food in infants who are not exclusively breastfed.^[12] Bahl et al have found in multicentre cohort study that there were no significant differences

in the risk of hospitalization between infants who were exclusively breastfed and those who were predominantly breastfed or between those who were partially breastfed and those who were predominantly breastfed. However, non-breastfed infants were at a substantially higher risk of all-cause hospitalization (P-value<0.001) and diarrhea-specific hospitalization (P-value <0.001), when compared with infants who had been predominantly breastfed. The risk of acute lower respiratory tract infections-specific hospitalization was also higher but was not statistically significant.^[6] The current study has revealed that the feeding pattern appears to be significant not only with hospital admission but also with frequency, the duration of hospitalization and the outcome of hospitalized infants. This is in agreement with study done by Barclay et al.^[16] A significant association of feeding pattern with infant mortality was also reported in this study. An earlier pooled analysis, by the WHO Collaborative Study Team on the role of breastfeeding on the prevention of infant mortality, has found point estimates of odd ratios for an increased risk of death ranging from 2.5 to 4.2 at different ages for children who had not been breastfed when compared with those who had had any breastfeeding.^[21] From this study it can be concluded that feeding pattern among hospitalized infants has revealed a significant association with bottle feeding and partial breast feeding compared to exclusive and predominant breast feeding in addition to a significant association between the feeding pattern and hospitalization especially for diarrhea and respiratory tract infection. Interventions to improve infant feeding practices could result in a considerable improvement in infant's health and reduction in the risk of hospitalization and death. Mothers and fathers should have access to objective, consistent and complete information about appropriate feeding practices. In particular, they need to know about the recommended period of exclusive and continued breastfeeding; the timing of the introduction of

complementary foods; what types of food to give, how much and how often; and how to feed these foods safely.

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