

Influence of feeding pattern on risk factors of lower respiratory tract infections in infants

Received: 21/1/2013

Accepted: 14/4/2013

Kawes O. H. Zangana *

Dhahir Tahir Gardi *

Abstract

Background and objective: Human milk is recommended as the exclusive nutrient source for feeding infants for the first six months of life and should be continued with the addition of solid foods after six months of age. This study is designed to study the socio-demographical risk factors on lower respiratory tract infections and influence of feeding on these factors.

Methods: A well matched case control study performed on 200 children admitted with acute lower respiratory tract infections to Raparin Pediatric Teaching Hospital – Erbil city in the period of 1st September 2010 to 1st May 2012. Children between 2 months and 2 years of age presenting with an acute history of cough and rapid respiration or difficulty in breathing were included in the study, according to WHO criteria for ALRI. The study sample was divided into two groups: group 1 (cases) and group 2 (control) . After that the cases were subdivided to two groups; bottle fed or mixed fed group and a exclusive breast fed group.

Results: This study showed that 69% of bottle-fed infants developed lower respiratory tract infections compared with 31% infants of breast-fed. This was significant statistically (p value 0.013). Mean age was 9.8 ± 2.6 months; male: female ratio was 1.5:1. Concerning vaccination status; cases were had lower level of vaccination, history of respiratory infection in the family was highly recognized as a risk factor.

Conclusion: infants who are more prone to develop respiratory infections are those of bottle fed, low level of vaccination, less than one year of age, family history of respiratory infections, low socio economical status and overcrowd families.

Keywords: lower respiratory tract infection, breast-feeding, bottle feeding and children.

Introduction

Human milk is recommended as the exclusive nutrient source for feeding term infants for the first six months of life and should be continued with the addition of solid foods after six months of age¹. Breast feeding for all infants is strongly supported because of its acknowledged benefits with respect to nutrition, gastrointestinal function, host defense, and psychological well being¹⁻⁴. Human milk contains a variety of heterogeneous agents that possess antimicrobial activity⁵. Specific proteins, such as lactoferrin, lysozyme, and serum immunoglobulin A, they are generally resistant to proteolytic degradation, line the mucosal surfaces preventing microbial attachment, and inhibit

microbial activity⁶⁻⁸. Human milk contains white blood cells, 90 percent of which are neutrophils and macrophages. These cells contribute to antimicrobial activity through phagocytosis and intracellular killing⁹. In both developed and developing nations, human milk compared to formula decreases the risk of acute illnesses during the time period that the infant is fed¹⁰. In developing countries, the overall morbidity and mortality is lower in breast-fed versus formula-fed infants⁹. In addition, the incidence of gastroenteritis and respiratory disease is lower in breast-fed infants¹¹. Respiratory illnesses are reduced in frequency and/or duration in breast-fed compared to formula-fed infant¹²⁻¹⁵ This is

* Department of Pediatric, College of Medicine, Hawler Medical University, Erbil, Iraq

illustrated by the following, breast-fed compared to formula-fed infants had a lower incidence of respiratory illness during the first 13 weeks of life^{12,14}, decrease in the incidence of wheezing and lower respiratory tract infection for breast-fed compared to formula-fed infants in the first four to six months of life^{12,13}. The rate of hospitalization for lower respiratory illnesses was reduced in infants exclusively breast-fed compared to those who never breast-fed^{11,12}. Increasing the duration of exclusive breastfeeding resulted in decreasing risk of hospital admissions for acute infections^{15,16}. Post-breastfeeding protection appears to increase with the duration of breastfeeding¹⁶. After adjusting for demographic variables (including ethnicity and socioeconomic status), childcare, and smoking exposure, infants who were exclusively breast-fed for four to six months compared to those exclusively breast-fed >6 months were more likely to develop pneumonia¹⁷.

Methods

A well matched case control study was performed on 200 children admitted with acute lower respiratory tract infections to Raparin Pediatric Teaching Hospital – Erbil city in the period of 1st September 2010 to 1st May 2012. Children between 2 months and 2 years of age presenting with an history of cough and rapid respiration or difficulty in breathing were included in the study, according to WHO criteria for ALRI¹⁸. Children with asthma, hypotonia, cerebral palsy, peripheral circulatory failure, cystic fibrosis, congenital heart disease, tuberculosis, severe anemia, dehydration and prolonged cough more than 3 weeks and neonates were excluded. History was obtained about the age of mother at time of pregnancy, method of delivery, parity, educational status, onset of first feeding, pattern of feeding, residence, socioeconomical status, number of persons in the home and number of rooms, smoking in the family, anthropometric measures taken to the child

and putted on the growth charts pattern of feeding including breast, bottle or mixed feeding, duration of feeding, if they started bottle feeding at which age, number of bottles, way of sterilization, amount of feeding and why they start bottle feeding. Mother was considered to be literate or educated if she was able to read and write, and illiterate if she was not able to read and write¹⁹. Crowding index was measured by dividing family size (number of family members) by number of rooms and socioeconomical status was calculated according to a specific score depending on parents information (formal education, work status of both, owned or rented house, possession of a car and crowding index)²⁰. The study sample was divided into two groups: group one (cases) infants with lower respiratory tract infection and group two (control group) infants who visited the hospital for other reasons as dental or pediatric surgery consultations. The cases and control group compared for different factors. After that the cases (infants with lower respiratory tract infection) were subdivided to two groups bottle fed or mixed (breast with bottle fed group) and exclusive breast fed group to study relation of different factors in case group in comparison to pattern of feeding including the same risk factors studied in the previous data. Statistical analysis was done using SPSS 20 (Statistical Package of Social Science version 20, Chicago, IL). The data was initially presented in frequency distributions. T test used to compare means and the Chi-square for categorical variables to check relationship between acute lower respiratory tract infection and socio-demographical variables and P values of 0.05 or less were considered statistically significant. We used odds ratio (OR) to estimate the relative risk of acute lower respiratory tract infection by certain variables with 95% confidence interval (CI).

Results

This study showed that 69% of bottle-fed

infants developed lower respiratory tract infections compared with 31% infants of breast-fed this was significant statistically (p value 0.013). Male 60% were more affected than females 40%, with male: female ratio was 1.5:1, but the data were not significant statistically (p value 0.318). In concern to vaccination status; cases had lower level of vaccination 75% than control group 88% and statistically the results were significant (p value 0.027), concerning the age most of the cases were less than one year of age 70% and 30% were more than one year of age mean age was (9.8 ± 2.6) months, the results showed more percent of affected baby in less than one year of age and the risk of getting the problem is more in such age group (p value < 0.0001) was significant. Sixteen cases were less than 5th percentile in regard to weight of cases versus control group the p value was 0.0211, which was significant. Concerning the length of infants; in the cases 10% of

them were less than 5th percentile in contrast to 3 infants in control group bellow 5th percentile, thus the data were not quite significant Considering maternal and demographical risk factors of lower respiratory tract infection, Mean maternal age was 28.77 years in case group and it was 26.4 in control group with significant p value 0.009. Primi mothers were 38% of cases versus 29% mothers in control group which showed larger risk factor in case group but the p value was not significant, factors like maternal education level, smoking status and consanguinity between parents were higher considering the cases and p value was (0.2306, 0.3024 and 0.6827) respectively. Regarding the mean crowding index was 2.81 in case group and it was 2.5 in control group with significant p value 0.0031. Mean family size in cases was 5.7 in cases in contrast to control group which was 4.1 and p value was 0.002 as the results shown in Table1.

Table 1: Variable characters with lower respiratory tract infection

Children's characteristics	Cases (n=100)	Control (n=100)	OR	CI 95%	P value
A. Feeding pattern					
1. Breast fed	31	49			
2. Bottle fed and mixed fed	69	51	0.6739	0.4915 - 0.9240	0.0139
B. Gender					
1. Male	60	54			
2. Female	40	46	1.263	0.9415 - 1.695	0.1281
C. Age					
1. < 1 year	73	42			
2. ≥ 1 year	27	58	1.998	1.421 - 2.811	< 0.0001
D. Vaccination status					
1. Vaccinated	75	88			
2. Not or partial	25	12	0.6810	0.4929 - 0.8384	0.0075
E. Weight					
1. 5 th percentile	84	95			
2. < 5 th percentile	16	5	0.6159	0.4630 - 0.8194	0.0211
F. Length					
1. 5 th percentile	90	97			
2. < 5 th percentile	10	3	0.6257	0.4485 - 0.8728	0.0818
G. Family history of LRTI					
1. Present	82	23			
2. Not present	18	77	4.122	2.686 - 6.325	0.0001

Mother's characteristics					
A. Maternal age	28.77	26.4			0.009
B. Education					
1. Literate	52	64	1.287	0.9570 - 1.732	0.1148
2. Illiterate	48	36			
C. Parity					
1. Primi	38	29	1.217	0.9221 - 1.605	0.2306
2. Multipara	62	71			
D. Consanguinity					
1. Present	40	32	1.18	0.8984 - 1.563	0.3024
2. Not present	60	68			
E. Smoking					
1. Smoking	4	2	1.347	0.7517 - 2.415	0.6827
2. Not smoking	96	98			
Socio- demographic characteristics					
A. Socioeconomic status					
1. Low	55	39			
2. Medium or high	45	61	1.378	1.042 - 1.823	0.0336
B. Family size	5.7	4.1			0.002
C. Number of rooms	2.9	3.1			0.01
D. Crowding index	2.81	2.5			0.0031

Cases (infants with lower respiratory tract infection) were divided in to two groups in regard of pattern of feeding (breast fed versus bottle fed). Males were encountered 17 (54.9%) cases in breastfed infants and 43(66.4%) males affected in bottle fed infants, while females were 14 (45.1%) cases in breast fed in concern to 26 (37.6%) in bottle fed infants, the risk was higher in bottle fed group in regard to gender to get infections(relative risk 1.235). In concern to vaccination status in breast fed group 27 (87%) infants were completely vaccinated in contrast to whom didn't completely vaccinated; while in bottle fed infants 45(62.3%) of them were vaccinated completely in contrast to 21 infants who didn't complete their vaccination, these values showed higher risk of about two folds (relative risk 2.625) in getting infection between both feeding pattern groups with significance (p value 0.03). Concerning the age group; most of the infants were less than one year 70% of cases; in breast fed group 22 (71%)were less than one year of age and 9(29%)were more than one year

of age, with mean age of 10.3±3.1 months, while in bottle fed infants 48 (69.5%)were less than one year old in contrast to 18 (30.5) of more than one year with mean age (8.4±0.4) months; these results showed more percent of affected baby in less than one year of age and the risk of getting the problem is more in such age group (RR 1.455) and the p value was non-significant (0.73). four (13%) case were less than 5th percentile in regard to weight of breast fed versus bottle fed 12(18.9%) infants group the relative risk was 1.383 but the p value was 0.6654. Concerning the length of infants 2 (6.5%) of breast fed infants were less than 5th percentile in contrast to 8(11.6%) infants who bottle fed; which conclude that getting respiratory infection problems is more common in bottle fed groups (RR 1.611) while the p value was not significant (0.6654).Family history of respiratory tract infection was more in bottle fed 42(60.8%) and the data was significant statistically (p value 0.0047).Mean maternal age was higher in breast fed group 29.2 and it was 26.8 in

control group with significant p value 0.009. Primi mothers were 7(22.5%) in breast fed group versus 31(44.9%) mothers in bottle fed group which showed significant (p value 0.0448), factors like maternal education level illiterate mothers were 9(29%) in breast fed group to 38(45.1%) in bottle fed group, data showed to be significant

statistically (p value 0.0322). Consanguinity between parents and maternal smoking were higher in bottle fed group with higher relative risk (1.083, 0.8) respectively. Regarding crowding index was 2.5 in breast-fed groups and it was 3.1 in bottle fed group with significant p value 0.034, as these values shown in Table 2.

Table 2: Characters with lower respiratory tract infection comparing pattern of feeding

Children's characteristics	Breast fed (n=31)	Bottle fed and mixed fed (n=69)	OR	95% CI	P value
Children's characteristics					
A. Gender					
1. Male	14 (45.1)	26 (37.6)	1.235	0.6892 - 2.214	0.675
2. Female	17 (54.9)	43(66.4)			
B. Age					
1. < 1 year	22 (71)	48 (69.5)	1.455	0.6259 - 2.316	0.7371
2. ≥1 year	9(29)	18 (30.5)			
C. Vaccination status					
1. Vaccinated	27 (87)	45(62.3)	2.625	1.010 - 6.823	0.0441
2. Not or partial	4 (13)	24(34.7)			
D. Weight					
1. 5 th percentile	27(71)	56(81.1)	1.383	0.5557 - 3.440	0.6576
2. < 5 th percentile	4(13)	12(18.9)			
E. Length					
1. 5 th percentile	29 (93.5)	61(88.4)	1.611	0.4499 - 5.769	0.6654
2. < 5 th percentile	2 (6.5)	8(11.6)			
F. Family history of LRTI					
1. Present	9 (29)	42(60.8)	0.3930	0.2013 - 0.7676	0.0063
2. Not present	22(71)	27(39.2)			
Mother's characteristics					
A. Maternal age	29.2	26.8			0.009
B. Education					
1. Literate	22 (71)	31(44.9)	2.168	1.110 - 4.232	0.0281
2. Illiterate	9(29)	38(45.1)			
C. Parity					
1. Primi	7(22.5)	31(44.9)	0.4759	0.2273 - 0.9964	0.0448
2. Multipara	24(77.4)	38(55.1)			
D. Consanguinity					
1. Present	13(41.9)	27(39.2)	1.083	0.6001 - 1.956	0.8278
2. Not present	18(58.1)	42(60.8)			
E. Smoking					
1. Smoking	1 (3.2)	3(4.3)	0.8000	0.1427 - 4.483	1.0000
2. Not smoking	30 (96.8)	66(95.7)			
Socio- demographic characteristics					
A. Socioeconomic status					
1. Low	13(41.9)	42(60.8)	0.4815	0.2667 - 0.8693	0.0163
2. Medium or high	18 (58.1)	27(39.2)			
B. Family size	5.3	5.6			0.06
C. Number of rooms	2.9	2.2			0.034
D. Crowding index	2.5	3.1			0.027

Discussion

This study emphasizes that breast-feeding infants get less lower respiratory tract infections (LRTI); as this showed by other researchers^{16,17,21}. In a population-based survey, the rate of hospitalization for lower respiratory illnesses was reduced in infants exclusively breast-fed compared to those who never breast-fed (adjusted OR 0.66, 95% CI 0.47 to 0.92)²². There was a trend in reduced hospitalization in infants who were partially breastfed compared to those who never breast-fed (adjusted OR 0.60, 95% CI 0.47 to 1)¹¹ male gender were more prone to be affected than females which agrees with Drane DL et al¹⁹ and studies in Iraq^{23,24} and a study in India²⁵. This study and other studies showed that respiratory tract infections are more common among those who didn't receive vaccinations properly; this data showed by others in Iraq²³, while one other study in Iraq showed weak association of vaccination with lower respiratory tract infection²⁴. This study showed that children with lower anthropometric measures are more prone to get lower respiratory tract infections as these data agrees with other studies^{16,26}. The present study demonstrated a significant association of lower respiratory infection with presence of respiratory infection in another household sibling which agrees with other studies^{24,27}. The study of Yousif and Khaleq resulted in that children with household members affected with ARI were 4.17 more at risk to develop respiratory infections than those with no such history, but others found weak correlation for this factor²⁴. Maternal factors as maternal education, parity, consanguinity between parents showed to have no significant role in getting respiratory tract infections as this data agreed with other studies done in such associated factors^{23,25,27}. Maternal smoking, or smoking in the family showed no effect on getting lower respiratory infections this results also showed by Dlair Chalabi's²³ study. The studies of Kanchi and Kakeri²⁵ Dlair

Chalabi²³ agree that incidence of respiratory infection increase among children with low socioeconomic status as seen in this study. Overcrowding and large family size were additional risks for acquiring lower respiratory infections in children^{23,24,28,29}. The overall morbidity and mortality is lower in breast-fed versus formula-fed infants, the incidence of respiratory disease is lower in breast-fed infants^{9,10,11}. Our study showed that breast milk decreases the rate of getting lower respiratory infection, as its also emphasized by other studies³⁰⁻³² but there was no association in both groups regarding the gender and age; while the vaccination status showed to be higher in breast fed as coexisting factor in decreasing respiratory infections which plays a role in decreasing respiratory infections and indicates close care in the family^{24,33}. Respiratory illnesses are reduced in frequency and/or duration in breast-fed compared to formula-fed infants^{33,34}. In one study, breast-fed compared to formula-fed infants had a lower incidence of respiratory illness during the first 13 weeks of life (25.6 versus 37.0 percent)³³, which is also found in this study. Two studies reported a decrease in the incidence of wheezing and lower respiratory tract infection for breast-fed compared to formula-fed infants in the first four to six months of life^{34,35}. A study demonstrated that infants who received human milk who were vaccinated and had normal weight had fewer days of upper respiratory symptoms compared to those who were formula-fed during the first seven months of life (17.6 versus 38 days)³⁵, this observed in our study. Family history of respiratory infections seen more in families that other siblings were not taking breast milk than those who are always on bottle fed, this fact also ensured by Sadeharju K et al^{35,37}. Breast-feeding was less initiated and continued in mothers with younger ages as seen in a survey³⁸ and showed that is lower socioeconomically status is more associated with breast feeding attitude⁵, as this associations seen in this

study also. Maternal education has a role in starting breast milk as seen in this study compared to the survey which emphasize that Rates were lower in mothers who were not high school graduates and gets less attacks of respiratory infections and needs less hospitalizations³⁸.

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