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Breast Feeding in Relation to Health Outcomes at Nine Months Infants in Gaza Strip

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Abstract: Exclusive breast feeding is important practice that should be encouraged for normal growth and development of infants and provide great protection against many diseases. This study is a cross-sectional and non-randomized study that included a total of 343 mother-infant pairs, of which 251 infants were mixed fed, 92 infants were exclusively breast fed for 6 months. The results of growth (weight and length) show similar growth rate between exclusively breast fed infants for six months and infants who had mixed feeding. Head circumference for exclusive breast fed infants was higher than for mixed fed infants. The results also show significantly higher lipid profile (total cholesterol, LDL and HDL) and total protein levels for infants who were exclusively breast fed for six months compared with infants who were mixed fed while no significant differences in serum albumin between two groups was found. The results indicate that infants who were exclusively breast fed for six months had lower number of gastrointestinal tract, respiratory tract and urinary tract infections and otitis media than infants on mixed feeding. Regarding infants development, the current study showed that infants who were breast fed exclusively for six months have earlier gross and fine motor development; also they had early language development than infants who were on mixed feeding. It is concluded that human milk is uniquely superior to infant feeding and it is the healthiest feeding practice for infants and for normal growth and development, because it provides a reasonable protection against many diseases.

Key words: Exclusive breast feeding, morbidity, growth, development

INTRODUCTION

Breast milk contains several compounds that may have antimicrobial effect (Newburg *et al.*, 2004; Orsi, 2004). Some available data on growth show similar growth rate or body composition for a healthy term infants exclusively breast feed for 6 months compared to those exclusively breast feed for 3 or 4 months, who continued partial breast feeding to six months (Kramar and Kakuma, 2002). There is a general consensus that breast feeding protects against many infections. A previous review of diarrhea in both developed and developing countries reported that the risk of diarrhea in infants who did not receive breast milk were 3.5 to 4.9 times higher than infants who had exclusive breast feeding in the first 6 months of life (Stanley *et al.*, 2007; Seema *et al.*, 2008). Exclusive breast feeding protects against hospitalization for diarrhea. It is estimated that 53% of diarrhea hospitalizations could have been prevented each month if all infants were exclusively breast fed and 31% could have been prevented if all were partially breast fed (Maria and Amanda, 2007).

A lack of exclusive breast feeding in the first half of infancy is a risk factor for acute lower respiratory tract infection incidence, morbidity and death (Black *et al.*, 2008).

A longer duration of breast feeding gave a lower risk of infection after weaning, indicating a long-term mechanism (Marild *et al.*, 2004).

A series of experimental studies investigated the relative effects of feeding with breast and enriched formula milks on motor and cognitive development in early childhood (Morley *et al.*, 2004; Lucas *et al.*, 2001). Of these studies, higher motor development scores for breast fed infants compared with their formula-fed counterparts have been reported (Morley *et al.*, 2004; Fewtrell *et al.*, 2002; Lucas *et al.*, 1994) and the magnitude of the association was not attenuated when socioeconomic factors were taken into account (Morley *et al.*, 2004; Lucas *et al.*, 2001). The effects of infant feeding on blood lipids level show that, the exclusively breast fed infants had significantly higher Total Cholesterol (TC) and Low Density Lipoprotein Cholesterol (LDL-C) as compared to mixed-fed infants at both 14 weeks and 6 months (Harit *et al.*, 2007).

There are limited studies about breast feeding duration, benefits and in particular exclusive breast feeding on infant health and growth among infants in Gaza Strip. Thus, this study is the first one that will be conducted among our population that is concerned with exclusive breast feeding status among babies in Gaza Strip. This study determined the effect of exclusive breast feeding versus mixed feed on growth rate (weight for age and length for age) morbidity (GIT infection, Respiratory tract infection, Urinary tract infection and Otitis Media), hospitalization of infants due to respiratory tract infections and gastrointestinal infections, infant

development and lipid profile, total protein and albumin among Palestinian infants in Gaza Strip.

MATERIALS AND METHODS

Study design: This study is a cross-sectional and non-randomized study that target Palestinian mothers who have infants aged nine months and their infants.

Study population: To estimate breast feeding prevalence and evaluate of breast feeding effect on infant's health, all nursing women and their infants (who are born at healthy full term and with birth weight between (2500 g - 4000 g) without congenital defect nine months of age) have visited eight primary health care centers in Gaza Strip for 9 months vaccination were eligible for entry into this cross sectional study.

Ethical approval: This study was approved by local Research Ethics Committees of the Palestinian Ministry of Health (MOH) and Helsinki committee.

A written and signed consent form was obtained from each participant after explaining them the purpose and the method of study.

Data collection:

Information about infants, breast feeding as well as the health status of the infants were obtained by face to face interviews with mother and from the records of infants in the clinic if possible.

All participants have been interviewed with a well established and validated questionnaire (that include information about demographics, clinical and anthropometric measurements of infants). The questionnaires were filled by researcher.

Anthropometric measurements:

- Body weight at birth was recorded from reports at the moment of interview.
- Body weight of the infant was measured by means of a digital scale (seca scale), accurate to 0.1 kg.
- Infant's length was measured using the seca infantometer accurate to 0.1cm, with the infant lying down.
- Infant's head circumference was taken by a fiberglass tape to the nearest of 0.1cm.

Blood sampling: For investigations on lipid profile and total protein, a blood sample (approximately 3 ml) was collected in plane tube during the routine visit of mothers and infants to the primary health care center in Gaza Strip. The blood sample was directly labeled and submitted to the laboratory for lipid profile analysis. Serum level of total cholesterol for all blood samples were measured by Cholesterol oxidase/peroxidase Colorimetric assay. Serum level of HDL-cholesterol for all blood samples were measured by HDL Precipitation Colorimetric assay. Serum level of low density

lipoprotein for all blood samples were measured by LDL Direct Photometric assay. Serum level of total protein for all blood samples were measured by Biuret Colorimetric assay. Serum level of Albumin for all blood samples were measured by Bromocresol Green Colorimetric assay (Nicholson and Pesce, 2004).

Development study: To study development differences between exclusive breast feeding and mixed feeding among study population (infants), certain parameters will be evaluated. These parameters consist of three important aspects; gross motor, fine motor and language. In order to assess gross motor, time of setting and time of crawl will be determined for each infant by asking his/her mother during interview. Fine motor is assessed by time of reaction with objects. Finally, language development will be assessed by determining the time of first social smile and the time of first babble.

Data analysis: Quantitative variables are represented as mean (\pm SD) and qualitative variables as percentages. For demographic and clinical data analysis, quantitative variables will be compared by using student t-test. A p-value $<0.05\%$ will be considered as statistically significant. All data will be analyzed by use of SPSS software for windows; version 15.

RESULTS

Participants: A total of 343 mother-infant pairs were included in this cross sectional study, of which 251 infants were mix fed, 92 infants were exclusively breast fed for 6 months.

Demographic data of participants involved in the study (n = 343)

Parameter	Mixed feeding	Exclusive breast feeding	Total
Gender			
Male	121 (70.8%)	50 (29.2%)	171 (49.8%)
Female	130 (75.6%)	42 (24.4%)	172 (50.2%)
Total	251 (73.2%)	92 (26.8%)	343 (100%)

Effect of exclusive breast feeding on the health status of infants included in the study

Anthropometric measurements: Anthropometric measurements that have been evaluated in this study were length for age, weight for age and head circumference. Regarding the length for age, there was no significant differences between exclusive breast feeding infant for six months (71.9 ± 2.70 cm) and mixed feeding infants (72.2 ± 2.76 cm) $p = 0.3$. Similarly, there was no significant difference in weight for age between exclusive breast fed infant for six months (8642.9 ± 1316.47 gm) and mixed fed infants (8815.3 ± 1264.75 gm) $p = 0.27$. On the other hand, head circumference for exclusive breast fed infants was higher than for mixed fed infants (44.1 ± 1.39 cm and 43.7 ± 1.15 cm; respectively. $p = 0.007$).

Which is statistically significant. Thus the results on growth (weight and length) of the current study show similar growth rate for healthy term infants exclusively breast fed for six months compared to those who had mixed feeding during the first six months.

Morbidity: In the current study, the morbidity of infants at nine months was evaluated by studying the number of illness episodes. Illnesses that were evaluated include infectious gastrointestinal tract diseases, otitis media, infectious respiratory tract diseases, urinary tract infections and allergy.

Morbidity differences between exclusively breast fed (n = 92) and mixed fed (n = 251) groups of infants for six months

Parameter Number (%)	Mixed feeding	Exclusive breast feeding	p-value
GIT tract infection episodes	200 (80.0)	44 (47.8)	0.001
RTI episodes	209 (83.3)	43 (46.7)	0.001
Otitis media episodes	95 (38.0)	17 (18.4)	0.001
UTI episodes	65 (26.0)	5 (5.4)	0.001
Allergic episodes	33 (13.0)	11 (11.9)	0.4

GIT = Gastrointestinal; RTI = Respiratory Tract Infection; UTI = Urinary tract infection

Hospital admissions: The results of this study showed that the percent of hospital admission among infants was 27.4% of whom 50% was due to respiratory tract infections, 47.8% was due to gastrointestinal tract infections and 2.2 was due to both diseases. The current study found that, this relatively high rate of hospital admissions was also affected by breast feeding and shows that the number of hospital admission among exclusively breast fed infants for 6 months (n = 10 from 92 infants, 10.8%) was lower than the number of hospital admissions for the mixed fed infants (n = 84 from 251 infants, 33.4%), (Chi-Square p = 0.001).

Biochemistry:

Lipid profile (Total cholesterol, LDL cholesterol and HDL cholesterol). Total protein and albumin levels in the exclusive breast fed (n = 92) and mixed fed (n = 251) groups of infants for six months.

Parameter (Mean±SD)	Mixed feeding	Exclusive breast feeding	p-value
Total cholesterol	148.63±28.69	165.41±27.33	0.001
LDL cholesterol	74.66±22.39	83.26±21.66	0.032
HDL cholesterol	35.38±6.93	44.73±8.61	0.001
Total protein	6.54±0.35	6.70±0.35	0.005
Albumin	4.61±0.32	4.69±0.36	0.14

Development differences between exclusive breast fed (n = 92) and mixed fed (n = 251) infants for six months

Parameter (Days; mean±SD)	Mixed feeding	EB	P- value
Time of social smile	71.9±34.3	54.2±27.3	0.001
Time of first babble	85.4±42.4	63.9±40.9	0.001
Time of setting without support	191.7±38.9	177.7±41.8	0.004
Time of crawl	262.9±160.7	223.4±43.4	0.021
Time of reaction with objects	170.1±42.73	156.4±39.2	0.007

EB = Exclusive breast feeding

DISCUSSION

Anthropometric measurements: Regarding the effects of exclusive breast feeding on the anthropometric measurements of infants, the results of this study were consistent with the results of previous studies (Cesar *et al.*, 1999; Kramar and Kakuma, 2002; Khadivzadeh and Parsai, 2004). In this study we found insignificant differences in the length and weight between exclusive breast feeding and mixed fed infants; these results are in line with previous studies that found complementary feeding before 6 months was associated with increases in both weight and length, but by 9 months no significant difference was observed in either length-for-age or weight-for-age. Dewey (2001) explained their results by the fact that breast milk contain sufficient energy and nutrients that ensure suitable growth for infants in the first six months. On the other hand, the current study and previous studies (Michael *et al.*, 2003; Harit *et al.*, 2007) found significant differences in the head circumference between exclusive breast feeding and mixed fed infants.

Morbidity: The current study showed that infants who were exclusively breast fed for 6 months had a significantly lower number of gastrointestinal infection episodes than infants who were on mixed feeding. These results were consistent with the results of numerous other studies carried out earlier (Stanley *et al.*, 2007; Khadivzadeh and Parsai, 2004; Seema *et al.*, 2008). Also frequency of GIT infections was lower among exclusive breast feeding infants than mixed fed infants which come in line with the published data by Seema *et al.* (2008). Thus the results of this study support the fact of the protective role of exclusive breast feeding rather than total breast feeding, suggesting a dose-effect related to the greater amount of breast milk ingested by exclusively breast fed infants.

This study documented that exclusive breast feeding for 6 months provides greater protection against respiratory tract infection (46.7%) than does mixed feeding (83.3%) during the first 9 months as indicated by lower number and frequency of RTI among exclusive breast fed than among mixed fed infants. Findings of this study are consistent with the findings of numerous previous studies (Black *et al.*, 2008; Seema *et al.*, 2008; Caroline *et al.*, 2006; Khadivzadeh and Parsai, 2004; Koch *et al.*, 2003). The results of the current study showed that exclusive breast feeding for a period of 6 months can play a significant preventive role against otitis media. These findings are consistent with those of other studies published recently (Black *et al.*, 2008; Seema *et al.*, 2008; Caroline *et al.*, 2006; Khadivzadeh and Parsai, 2004; Koch *et al.*, 2003). This protective effect of breast feeding may be explained by the fact that human milk has immunologic and non-immunologic protective properties (Linda *et al.*, 1997).

The results of the current study showed that exclusive breast feeding lead to a significantly lower risk of UT infection in infants at age 9 months than infants on mixed feeding of the same age. These results are consistent with the results of previous studies (Marild *et al.*, 2004; Levy *et al.*, 2008). The clear mechanism of this protection is still unknown but many factors in breast milk may play a role in decreasing the number of urinary tract infection episodes such as secretory immunoglobulin A (IgA) which coat the pathogens and prevent them from reaching the urinary tract (Van der Waaij *et al.*, 1996).

Hospitalization: The results showed that exclusive breast feeding for 6 months have a protective effect on hospitalization as a result of infections. Where infants that were breast fed exclusively for the first 6 months had a lower number of hospital admissions than infants who were mixed fed. These results were consistent with the results of previous studies by Jose *et al.* (2006); Maria and Amanda (2007) and Flores *et al.* (1999). However two other studies in industrialized nations reported no breast feeding protection against hospitalizations as a result of infection, whether caused by gastroenteritis (Chen *et al.*, 1988) or infections in general (Kramer *et al.*, 2001). These controversial results among studies may be due to the fact that hospitalization is a multifactor outcome and many factors are attributable to infant hospitalization due to infections such as birth weight, sibling, maternal and family smoking, economical level and type of infant feeding (Jose *et al.*, 2006).

Development: Despite normal development of both feeding regimen groups (exclusive breast feeding and mixed feeding) among infants in Gaza Strip, the results of this study indicated that exclusive breast feeding for 6 months is associated with a beneficial effect on the development process of infants and showed that exclusive breast feeding for 6 months may help in protection against delays in young children's motor skill development. These results are in line with the results of previous studies that found some evidence of a dose-response relationship, with the greatest protection occurring in infants who were breast fed exclusively. (Morley *et al.*, 2004).

Results of this study showed that exclusive breast feeding may protect against delays in the infant language. As in gross and fine motor development, both feeding regimen groups of infants in Gaza Strip have normal language development, with faster development detected among exclusive breast feeding infants than mixed fed infants.

Biochemistry: The current study found differences in lipid profiles between two different feeding regimens. At 9 months, the exclusively breast fed infants for six

months had significantly higher TC, HDL-C and LDL-C as compared to the mixed-fed group. Similar findings were also found by other investigators (Harit *et al.*, 2007; Thorsdottir *et al.*, 2003; Owen *et al.*, 2002; Agostoni *et al.*, 2001; Wong *et al.*, 1993) where breast fed infants had significantly higher TC and LDL-C than formula-fed infants or mixed feeding infants. Total protein level in the exclusively breast fed infants was higher than that found in the mixed fed infants.

Human milk contains two types of proteins: whey and casein. Approximately 60-80% is whey, while about 40% is casein (Lonnerdal, 1985). This balance of proteins allows for quick and easy digestion. While milk formula, has a greater percentage of casein, it will be more difficult for the baby to digest, this may be the reason for that, total protein levels in exclusively breast fed infants for 6 months was higher than the level of total proteins in the mixed fed infants. On the other hand, serum albumin level was statistically insignificant between the two groups of infants.

Conclusion: Human milk is uniquely superior for infant feeding and breast feeding is the healthiest feeding practice for infants for normal growth and development and it provides a reasonable protection against many diseases. Thus, breast fed infants are the reference model against which all alternative feeding methods must be measured with regard to growth, health, development and all other short- and long-term outcomes.

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