

## Determination of effective factors in breastfeeding duration using survival analysis

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**Received: 1 May 2016**

**Revised: 2 Aug 2016**

**Accepted: 2 Nov 2017**

**Background:** Breast milk is the most suitable nutrition for the neonates. Breast milk and breastfeeding duration can contribute to decreased mortality rate, intestinal bleeding, and various neonatal diseases (e.g., digestive and respiratory diseases). It can also reduce the risk of diabetes and obesity in childhood and adulthood. Therefore, the estimation of breastfeeding duration and recognition of the effective factors in this regard can lead to designing and implementing appropriate programs, which can provide the foundations for the modification of breastfeeding behavior.

**Methods:** This survival study was conducted on 501 mothers with healthy and single birth neonates born within March 21, 2011-September 21, 2012 with active medical records in Aqqala city, Golestan province, Iran, in the second half of 2014. The data were collected from the information registered at the archives of health centers by in-person visiting. In addition, some of the information was collected through phone contacts. The duration of breastfeeding was estimated in month. Data analysis was carried out using the Cox regression in the STATA software, version 11.

**Results:** According to the results, the mean and median of breastfeeding were 20.44 and 22 months, respectively. According to the Cox regression, maternal ethnicity, living with family, birth spacing, type of milk consumed along with complementary nutrition, and type of neonatal nutrition during the hospital stay of the infant had a significant relationship with the early cessation of breastfeeding.

**Conclusion:** Based on the findings of the present study and the identified factors affecting the breastfeeding duration, it seems necessary to provide the essential trainings for the young mothers and pregnant women to avoid of reducing the duration of breastfeeding. These educations can be included in the programs of the Health centers of the universities and urban and rural medical clinics.

**Keywords:** Cox regression, Duration of breastfeeding, Effective factors, Survival analysis

## Introduction

Breast milk is the best type of nutrition for the neonates. The consumption of this milk is recommended for all newborns due to its accessibility, appropriate temperature, freshness, and lack of contamination (1). Accordingly, the religious and cultural Islamic teachings have also underscored the benefits of breastfeeding (2). Breast milk not only has an important role in neonatal nutrition, but also decreases the mortality, intestinal bleeding (3), various neonatal diseases (e.g., digestive and respiratory diseases) (4), and diabetes and obesity in childhood and adulthood (5).

Moreover, breast milk might protect the mothers against breast, ovarian, and endometrial cancers as well as risk of rheumatoid arthritis (6). The World Health Organization and United Nations Children's Fund have recommended the exclusive breastfeeding up to the first 4-6 months of the neonate's life, followed by complementary feeding and breastfeeding continuation for up to two years of age (7).

Survival analysis is a suitable statistical method for the data analysis in which the dependent variable is the length of time until the occurrence of an event. Today, the survival analysis is used in the majority of scientific studies involving the assessment of duration until the occurrence of an event (e.g., duration until the breastfeeding cessation) (8). In the survival analysis, if the aim is to describe the survival time without considering the explanatory variables, the nonparametric methods, such as life table analysis and Kaplan-Meier survival analysis, are applied.

However, if the goal is to assess the effects of explanatory variables on survival time, the regression models of survival are employed. In this study, the Kaplan-Meier method was applied to estimate the median and mean of survival duration. Furthermore, the Cox regression (proportional hazards regression) was utilized to detect the effective factors in this regard.

## methods

This survival study was conducted in Aqqala city, located in Golestan Province, Iran, in 2014. The study population included

all mothers with healthy and single birth neonates referring to the health centers of Aqqala city (both rural and urban areas) from March 21, 2011 to September 21, 2012. The participants were selected through stratified random sampling technique. The sample size was calculated as 501 individuals, who were divided in proportion to the covered population living in the rural and urban areas.

Given the great extent and volume of the study, we used a team consisting of experienced and educated people in the field of working with mothers and neonates, who were provided with an educational course to get familiar with this subject (e.g., how to collect data checklist). The data used in this study and their descriptive variables were collected using the medical records of the neonates and pregnancy records of the mothers. Other information was gathered through phone calls or in person.

The application of Cox regression requires the establishment of the proportional hazards. The breastfeeding cessation until 24 months of age was regarded as event occurrence. At first, the significant variables were determined using log-rank test, followed by the fitting of multiple Cox regression. The establishment of Cox regression assumption was assessed using Log-log plot. Data analysis was carried out in the STATA software, version 11.

## Results

In this study, 501 neonates, including 253 males (50.6%) and 248 females (49.5%) were evaluated. The cessation of breastfeeding did not occur in 118 (23.7%) cases until the end of 24 months (right censoring). The majority of the neonates (n=222, 44.3%) were first-born. In addition, in terms of the education level, most of mothers (n=447, 95.2%) were below diploma, and only 18 (3.6%) ones had an academic degree. The range of mothers was 15-42 years. In 386 (78%) newborns, complementary nutrition was initiated at the age of six months. The mothers' religion, place of residence, and ethnicity were also evaluated (Table 1).

Table 1. Demographic characteristics of mothers and neonates		
Variables	(% Number)	
Religion	Islamic	76(15/2)
	Sunni	425(84/8)
Ethnicity	Fars	2(0/4)
	Turkmen	411(82)
	Baloch	17(3/4)
	Sistani	71(14/2)
Place of residence	City	137(27/4)
	Village	364(72/6)
Number of children	One child	171(34/1)
	Two children	226(45/1)
	Three children	80(16)
	More than three children	24(4/8)
Birth order	First	222(44/3)
	Second	181(36/1)
	Third	78(15/6)
	Fourth or higher	20(4)
Birth weight	2500 gr $\leq$	646(92/6)
	2500 gr $\geq$	30(6)
	Unknown	7(1/4)
Neonatal hereditary disease	No	491(98)
	Yes	8(1/6)
	Unknown	2(0/4)

In total, 51 (17.3%) mothers reported that the reason of breastfeeding cessation to be the dependency of neonates on breast milk, which is accompanied by their refraining from eating complementary foods. In addition, 41 (13.9%) of the participants ascribed the cessation of breastfeeding to their decreased lactation. The mean and median of breastfeeding were 20.44 and 22 months with standard errors of 0.388 and 0.206, respectively. The survival rates of breastfeeding until 6, 12, 18, and 24 months were 96.2, 95, 69.3, and 23.7, respectively.

Based on the Cox single-variable model, the factors affecting the duration of

breastfeeding were identified and entered in the multiple Cox regression. The results revealed that the maternal ethnicity, living with maternal family, birth spacing, type of milk consumed along with complementary food, and type of neonatal nutrition during the hospitalization of the infant could be significantly associated with early breastfeeding cessation. However, the early cessation of breastfeeding showed no significant relationship with the number of children, type of delivery, age of complementary nutrition initiation, neonatal gender, and family income (Table 2).

**Table 2.** Factors affecting the duration of breastfeeding (Cox regression)

Factors	Single variable			Multiple variables		
	Confidence interval %95	Risk ratio EXP( $\beta$ )	P-value	Risk ratio EXP( $\beta$ )	Confidence interval %95	P-value
Birth order			0.016			
Third child or higher to the first child	(1.092, 1.916)	1.446	0.01			
Maternal religion	(1.233, 2.088)	1.604	<0.001			
Maternal ethnicity			0.002			0.003
Baloch to Turkmen				1.394	(0.837, 2.321)	0.202
Sistani to Turkmen		0.596	<0.001	1.634	(1.221, 2.187)	0.001
Place of residence	(1.026, 1.575)	1.271	0.028			
Living with family	(1.135, 2.618)	1.724	0.011	1.582	(1.038,2.413)	0.033
Number of children	(0.781, 1.003)	0.885	0.057			
Birth spacing	(0.992, 0.999)	0.996	0.019	0.996	(0.992,0.999)	0.019
Type of neonatal nutrition during the hospital stay of the infant (breast milk)			0.036			0.041
Others	(1.144, 7.118)	2.854	0.025	34.775	(2.174, 556.170)	0.012
Type of neonatal nutrition during the hospitalization of the mother (breast milk)			0.005			
Others	(2.139, 54.048)	10.752	0.004			
Type of milk consumed along with complementary nutrition (breast milk)			<0.001			<0.001
Baby formula	(4.238, 11.670)	7.032	<0.001	15.810	(9.364, 26.692)	<0.001
Use of pacifier, sugary water, and complementary food along with breast milk	(0.994, 1.623)	1.270	0.056			

## Discussion

The findings of this study revealed that the median and mean of breastfeeding were 22 and 20.44 months, respectively, with the standard error of 0.206. In addition, the survival rates of breastfeeding up to 6, 12, 18, and 24 months were estimated to be 95.962, 693.0, 0.0, and 0.237, respectively. Consistent with our findings, in a study conducted by

Rahimzadeh et al. (2005) in Mazandaran, Iran, the median and mean breastfeeding were 22 and 21±4.6 months, respectively (9). On the other hand, in a study carried out by Roudbari, the median of breastfeeding duration was 15 months with the standard error of 1.17 months (10). It seems that median is a better estimation for reporting the breastfeeding duration.

In the present study, ethnicity, living with family, birth spacing, type of milk consumed along with complementary nutrition, and type of neonatal nutrition during the hospitalization of the infant were detected as the factors affecting the early cessation of breastfeeding. In this regard, in a study performed in Bangladesh, Shamima Akter and Mizanur Rahman (2010) recognized maternal age, age at marriage, number of pregnancies, religion, place of residence, maternal education level, occupational status, type of delivery, and use of contraceptives as the factors affecting the duration of breastfeeding (8). The discrepancy between our findings and those of the mentioned study can be ascribed to the fact that the two studies evaluated different factors.

According to the results of Rahimzadeh et al. (2005), the most effective factors in the duration of breastfeeding included the place of residence, multi gestation, maternal occupational status, type of pregnancy, consuming milk other than breast milk, giving tea and other types of herbal tea, number of breastfeeding, and support of the spouse (9).

In addition, in a study conducted by Roudbari in Zahedan, the duration of breastfeeding was reported to have a significant relationship with maternal and neonatal age, maternal education level, breastfeeding at night, number of breastfeeding during a day, breastfeeding to ill infant, and breastfeeding of ill mother to infant (10). The aforementioned findings are inconsistent with the results obtained in the present study. This lack of consistency might be due to the investigation of different variables in these two studies.

The results obtained by Jafari Asl et al. in Rasht (2014) demonstrated that premature delivery, maternal occupation, insufficient amount of breast milk, consumption of contraceptives, breastfeeding strike, maternal attitude toward breastfeeding, and consumption of baby formula were the factors affecting the duration of breastfeeding. They demonstrated that breast milk insufficiency (OR: 22.23,  $P < 0.001$ ) and use of contraceptives during breastfeeding (OR: 12.75,  $P < 0.002$ ) had the strongest association with breastfeeding duration (11). In the

present study, the use of baby formula was effective in the duration of breastfeeding, which is in line with the results of the mentioned study.

Alberto Feldens et al. (2012) regarded the independent use of pacifier in the first month of life to be related to the modification of confounding factors (R.R=3.12, 95% CI: 2.13-4.57). In the mentioned study, the breastfeeding cessation ratio was lower in the neonates, who received milk bottle or pacifier in the first month of life, compared to others (12). In the current study, the use of pacifier, sugary water, and complementary food along with breast milk in the first six months of life had an impact on the duration of breastfeeding, which is in congruence with the findings of the aforementioned study.

In a study conducted by Pourahmad et al. (2014), maternal occupation had a significant relationship with the cessation of breastfeeding. In the mentioned study, 38% of the mothers were employed, which had a negative effect on the continuity of breastfeeding (13). In addition, Hosseini et al. (2010) regarded the maternal occupation as the most important factor affecting the duration of breastfeeding (14). Nevertheless, in the present study, no significant association was observed between the occupation of mother and duration of breastfeeding since the majority of our participants (98.8%) were homemakers.

Furthermore, Hajian (2001) reported no significant difference between the urban and rural subjects in terms of the possibility of breastfeeding continuity up to the age of 12 months. Nonetheless, the urban participants showed a significant decrease in the breastfeeding after 12 months, compared to the rural mothers. According to the results of the mentioned study, higher birth order significantly decreased the risk of reduced breastfeeding (15).

In the current study, the median of breastfeeding duration was significantly different between the urban and rural mothers. In this regard, the rural mothers breastfed their children averagely 1.5 months longer than the urban mothers. Therefore, the infants of the urban mothers were more exposed to the risk of early cessation of

breastfeeding. In a study by Morovati et al. (2013), the percentage of exclusive breast feeding until the age of six months was 6.1% (16). However, this amount was reported to be 78% in the current research. This inconsistency might be due to the fact that the Turkmen people strongly believe in the importance of breastfeeding.

The results of this study revealed that the use of baby formula along with complementary nutrition was the most effective factor in the early cessation of breastfeeding. Given the fact that the use of baby formula is an important and effective factor in the breast milk nutrition, the mothers

are recommended to use complementary foods along with breast milk for the continuity of breastfeeding.

### Acknowledgements

This article was derived from a Master's thesis submitted by Ameneh Sadat Sheikholeslami in biostatistics with the project code of 1456. The study was approved by the Research Council of the Deputy of Research and Technology of the Mazandaran University of Medical Sciences, Mazandaran, Iran. Hereby, we extend our gratitude to all personnel of healthcare centers of Aqqola for their cooperation.

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