

*Research Article***Breastfeeding practice and perception among women attending Primary Health Care Center in Giza, Egypt**

Nashwa N. Kamal*, Fatma H. Ismael**,
Marwa G. Abdelrehim* and Ayman S. El-Khateeb*

* Department of Public Health and Preventive Medicine, Faculty of Medicine, Minia University, Egypt.

** Family planning registrar, Giza, Egypt.

Abstract

Background: Breastfeeding is an unequalled way of providing ideal food for the healthy growth and development of infants; it also affects the reproductive process, with important implications for maternal health. The global public health recommendation is that infants should be exclusively breastfed for the first six months of life, starting in the first half hour after delivery. There are various factors that affect the decision regarding the initiation and duration of exclusive breastfeeding, including socio-demographic factors (education level, monthly household income, and parity), residence and cultural beliefs, employment policies, health-related factors, and biosocial factors (breastfeeding support). In Egypt, the Egypt Demographic and Health Survey (**EDHS, 2014**) shows that exclusive breastfeeding is common but not universal in very early infancy. Among infants under two months of age, 71% received only breast milk. However, the proportion exclusively breastfed drops off rapidly among older infants. **Aim of the study:** To assess the practice and perception level of breastfeeding among women attending the Primary Health Care Center in Giza, Egypt. **Research methodology:** This study is cross-sectional study among women had at least one child aged 2 years or younger, included 380 participants, recruited from Primary health care center in Giza. Face to face interview questionnaire was used in data collection. **Results:** The practice level of breastfeeding was significantly affected by women' age, residence, work status and socio-economic level. Women with higher breastfeeding perception score had higher odds for good practice (AOR, 1.16; 95% CI, 1.04-1.3). **Conclusion:** The study findings revealed effect of work on practice level of breastfeeding, and it was that poor practice level was found more likely among women with longer working hours and women who were taking longer time to reach work. **Recommendations:** Early initiation of breastfeeding within the first hour of infant life, the infant only receives breast milk, breastfeeding on demand – often as the child wants, day and night and no use of teats, bottles, or pacifier

Key words: Breastfeeding, practice, perception, Giza.

Introduction

Breastfeeding and human breast milk are the normative standards for ideal feeding and nutrition for infants (**Gartner et al., 2012**) with many established short- and long-term benefits (Young, 2016). According to World Health Organization (WHO, 2017), exclusive breastfeeding is recommended for infants during their first 6 months of life.

This should be continued in conjunction with the appropriate complementary food

for up to 2 years or beyond. However, currently, fewer than 40% of infants under 6 months of age are exclusively breastfed worldwide (WHO, 2011). Many factors affect exclusive breastfeeding in the first six months of life, including maternal socio-demographic traits and medical factors (Girish and Gandhimathi, 2015).

The following four leading reasons women often report for breastfeeding discontinuation: breast discomfort (including nipple pain), perceived insufficient

milk supply, a negative family or healthcare support system, or conflicts with other activities, such as employment (Otsuka et al., 2008). Length of maternity leave, occupation type and status, workplace accommodations, and supportive policy are factors known to impact women's breastfeeding initiation and duration (Attanasio et al., 2013; Bai & Wunderlich, 2013).

Subjects and methods

Study design

This is a cross-sectional study carried out in Giza governorate. The study sample recruited from Primary health care center, which were selected randomly, where women had at least one child aged 2 years or younger were attending to get contraceptive methods or have vaccines for their infants. The sample size of this study was calculated using a 95% confidence interval (Newcombe formula) and was found to be 380 mothers (<http://www.surveysystem.com/sscalc.htm>) (Creative Research Systems, 2014; Newcome, 1998).

Data collection

Data collection tool

Questionnaires were printed and fulfilled by the researcher during the interviews with mothers. On the basis of the participants' responses, their perception and practices of breast feeding were assessed.

Ethical consideration

The study protocol was approved by the research ethical committee of faculty of Medicine in Minia University. Approval of the faculties' deans was obtained. Data were collected from participants after explaining the nature of the study and taking verbal consent from each of them. Confidentiality, privacy, and freedom to withdraw from the study on the participant's decision were assured.

Statistical analysis

After the collection of the questionnaires, the obtained data were organized using the MS Excel software program, coded, and analyzed using the Statistical Package for Social Sciences (SPSS) version 22. Means and standard deviation (SD) were used for numerical data, whereas percentages were used for categorical data. First, chi squared (χ^2) test and independent t-test were conducted to assess the effect of certain factors on breastfeeding perception and practices. Second, the predictors of perception and practice levels were determined using multinomial logistic regression analysis. Adjusted odds ratio (AOR) with 95% confidence interval (CI) was computed and a p-value less than 0.05 was selected as the cut-off for statistical significance.

Results

The age of the participants ranged from 18 to 44 years old. 49.2% of the participants lived in urban areas, about half of the females 49.2% had secondary or intermediate education and 33.9% of the participants were working mothers.

Table (1): Socio-demographic characteristics of the studied women attending Primary Health Care Center in Giza, Egypt, 2019

	Total participants (n=380)
	N (%)
Age	
Mean \pm SD	28.68 \pm 5.71
(Range)	(18-44)
Religion	
Muslim	344 (90.5%)
Christian	36 (9.5%)
Marital status	
Married	376 (98.9%)
Divorced	4 (1.1%)
Residence	
Rural	64 (16.8%)
Urban slum	129 (33.9%)
Urban	187 (49.2%)
Education	
Illiterate – Read & Write	56 (14.7%)
Primary	13 (3.4%)
2ry/intermediate	187 (49.2%)
University/postgrad.	124 (32.6%)
Occupation	
Housewife	251 (66.1%)
Manual worker	20 (5.3%)
Clerk/Professional	109 (28.6%)
Education of husband	
Illiterate – Read & Write	47 (12.4%)
Primary	8 (2.1%)
2ry/intermediate	178 (46.8%)
University/postgrad.	147 (38.7%)
Occupation of husband	
Manual worker	72 (18.9%)
Business	108 (28.4%)
Clerk/Professional	200 (52.6%)
Numbers of family members	
< 5 members	219 (57.6%)
\geq 5 members	161 (42.4%)
Income from all sources	
Insufficient	34 (8.9%)
Meet routine expenses	312 (82.1%)
Able to save money	34 (8.9%)

Table 1 shows that the mean age of the studied mothers was 28 ± 5.7 years, (98.9%) of them were married and (49.2%) of them came from Urban areas. About one third of women and 38.7% of husbands had higher education. More than half of husbands (52.6%) had clerk and professional occupations, while more than half (66.1%) of mothers were housewives. Most of the families (57.6%) were less than five members and the majority (82.1%) met their routine expenses only.

Table (2): Breastfeeding practices among the studied women attending Primary Health Care Center in Giza, Egypt, 2019 (Answer yes)

		Total participants (n=380)
		N (%)
Have your baby received pre-lacteal food?	Yes	202 (53.2%)
Have your baby received colostrum?	Yes	344 (90.5%)
Time to initiate breastfeeding	1 st day after delivery	314 (82.6%)
	2 nd day	18 (4.7%)
	3 rd day	22 (5.8%)
	After that	26 (6.8%)
Duration of exclusive breastfeeding (months)	Mean \pm SD (Range)	3.54 \pm 1.62 (0-9)
Frequency of breastfeeding in the 1st 6 months	every 1 hour	127 (33.6%)
	every 2 hours	131 (34.7%)
	every 3 hours	48 (12.7%)
	Other	72 (19.0%)
Did you take any supplement during breastfeeding?	Yes	107 (28.2%)
Did you take special diet or food items to increase the milk during breastfeeding?	Yes	291 (76.6%)
Did you practice milk expression to be used to feed the baby while you are outside the home or in the work?	Yes	16 (4.2%)
Baby age at time of weaning (months)	Mean \pm SD (Range)	15.69 \pm 8.08 (0.5-24)

Table 2 shows the breastfeeding practices among the studied mothers. It was found that 53.2% of babies received pre-lacteal food and 90.5% received colostrum. More than half of mothers (68.6%) initiated breastfeeding during the first hour after delivery and the mean duration of exclusive breastfeeding was about three and half months.

Table (3): Barriers to breastfeeding among the studied women attending Primary Health Care Center in Giza, Egypt 2019 (Answer yes)

	Yes
Lack of knowledge about benefits of Breastfeeding	7 (1.8%)
Misconception that formula is equivalent	6 (1.6%)
Lactation problems	228 (60.0%)
Lack of support and embarrassment about feeding in public	6 (1.6%)
Returning to work and accessing supportive childcare	92 (24.2%)
Other problems (as immersed nipple, mother feels that breastfeeding is boring, infant stayed long time in the incubator, the mother taking medicine preventing her to breastfeed)	91 (23.9%)

Table 3 shows that the main barrier to breastfeeding was lactation problems (60%) followed by returning to work (24.2%). Other barriers included were lack of knowledge about benefits of breastfeeding (1.8%), misconception that formula is equivalent and lack of support and embarrassment about feeding in public (1.6%).

Figure (1): Breastfeeding practice among the studied women attending Primary Health Care Center in Giza, Egypt 2019

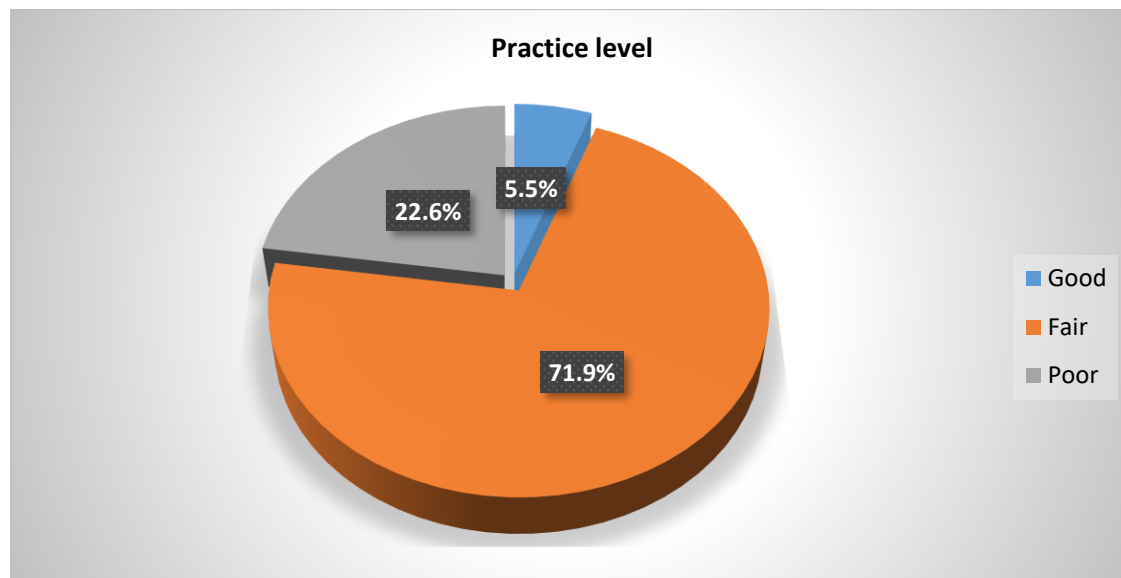


Figure 1 shows that 71.9% of the studied women had fair breastfeeding practice, 22.6% had poor practice and only 5.5% of them had good breastfeeding practice.

Table (4): Perception regarding advantages of breastfeeding among the studied women attending Primary Health Care Center in Giza, Egypt 2019 (Answer yes)

Perception regarding advantages of breastfeeding	Yes
Superior nutrition	327 (86.1%)
Increase resistance to infection	293 (77.1%)
Decrease risk of allergies & lactose intolerance	62 (16.3%)
Breast milk is sterile & cheap	304 (80.0%)
Fewer stomach upset & constipation	313 (82.4%)
Having higher IQs due to good brain development	97 (25.5%)
Babies benefit emotionally	147 (38.7%)
Babies sucking causes mother's uterus to contract	83 (21.8%)
Mothers breastfeed loss weight	60 (15.8%)

Table 4 shows that the majority of mothers know that breast milk is superior nutrition (86.1%), sterile and cheap (80%), associated with fewer stomach upset (82.4%) and increase resistance to infections (77.1%).

Table (5): Perception of the studied women attending Primary Health Care Center regarding disadvantages of bottle feeding in Giza, Egypt 2019 (Answer yes)

Disadvantages of bottle feeding	Yes
Bottle feeding is less convenient during midnight	245 (64.5%)
Formula food expensive &transit infection	298 (78.4%)
Absence of Antibodies	181 (47.6%)
Loose bond bet mother &child	107 (28.2%)
Affect digestive system	348 (91.6%)

Table 5 shows that most mothers know that bottle feeding can affect digestive system of the baby (91.6%), formula food is expensive and may transit infection (78.4%), and bottle feeding is less convenient during midnight (64.5%). Moreover, 47.6% of women know that bottle feeding lack antibodies and 28.2% believe that bottle feeding may cause loose bond between mother and child.

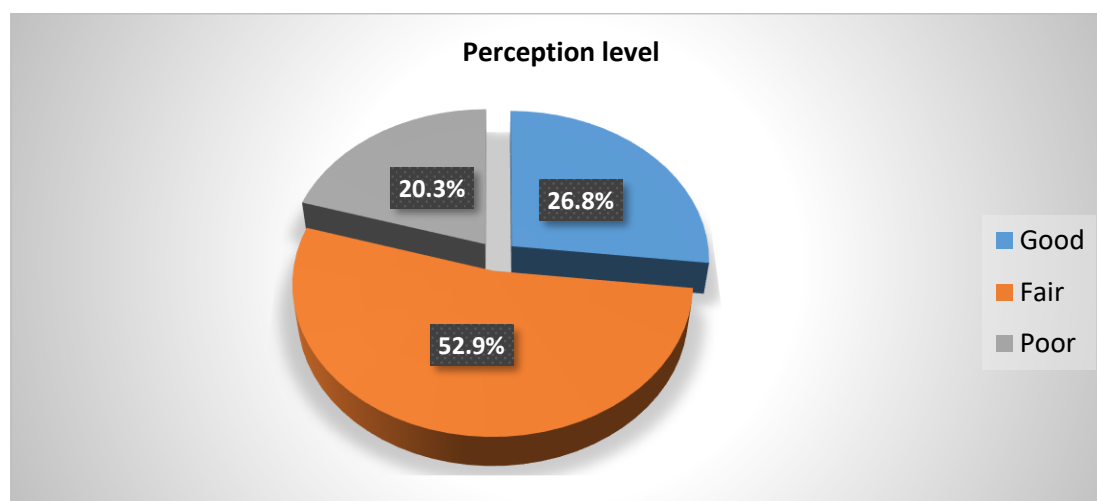
Figure (3): Breastfeeding perception among the studied women attending Primary Health Care Center in Giza, Egypt 2019

Figure 3 showed that 52.9% of the studied women had fair perception level of breastfeeding, 26.8% had good level and 20.3% of them had poor perception level.

Figure (4) Perception of the disadvantages of bottle feeding among the studied women attending Primary Health Care Center in Giza, Egypt, 2019, according to the work status

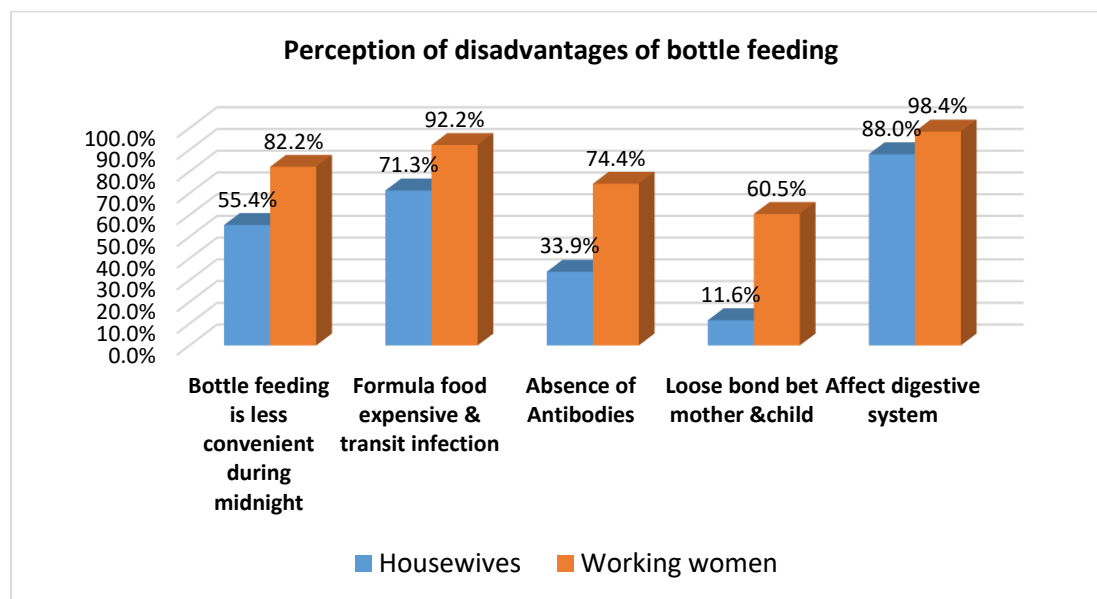


Figure (4) shows that most of housewives think that bottle feeding affecting digestive system (88%) and most of working women (98.4%) think that also. (60.5%) of working women think that bottle feeding losing bond between mother and child, while (11.6%) of housewives think that.

Figure (5) Baby age at weaning among the studied women attending Primary Health Care Center in Giza, Egypt, 2019, according to the work status

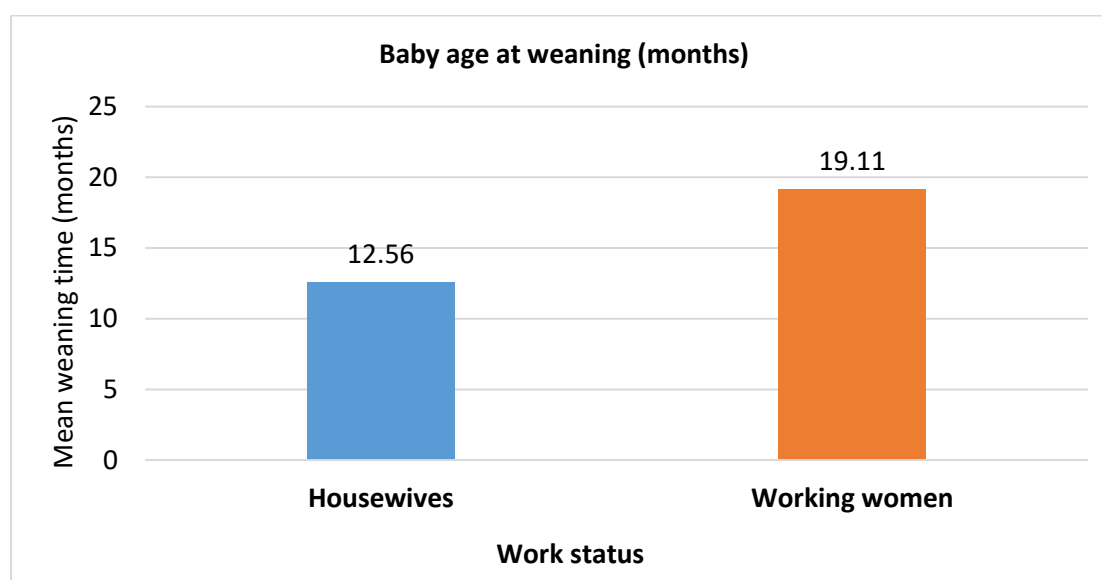


Figure (5) Shows that baby age at weaning were 12.56 months among housewives, while were 19.11 months among working women.

Discussion

This study showed that 82.6% of the mothers initiated breastfeeding in the first day after delivery, which was much higher than what was reported by Shiv *et al.* (2012), which found that only 20.9% of mothers started breastfeeding within one hour after delivery (Bhardwaj *et al.*, 2012). Nearly 90.5% of infants had received colostrum. This finding was similar to a study that was conducted in Nepal where 83.3% of children received colostrum (Yadav *et al.*, 2013). Out of 380 mothers, 53.2% of breastfeeding mothers gave pre-lacteal feeding, which was greater than what found in a study conducted on Saudi mothers whom been admitted for delivery at maternity hospitals in Riyadh, where pre-lactical feeding was practiced by 10.5% of mothers (Al-Shoshan, 2007). The average duration of exclusive breastfeeding (EBF) was 3.5 months. This may be due to suboptimal level of knowledge and awareness about EBF among the participant mothers. Similar results have also been detected in Ethiopia showed that Knowledge of study participant mothers who attend antenatal care and immunization clinic towards exclusive breastfeeding was poor (Alamirew *et al.*, 2017). In this study, the range of infant age at the time of weaning was 15 months. Similarly a few percentage of mothers in Saudi Arabia (2%) continue breastfeeding at 2 years of age (El Mouzan *et al.*, 2009). The main reasons for breastfeeding cessation were reported as insufficient breast milk, pregnancy, the use of contraceptive pills, and returning to work (Fida & Al-Aama, 2003; Al-Hreashy *et al.*, 2008).

The major barrier that influenced the continuation of breastfeeding was lactation problems (60%) (as tiredness of mother, sore or painful nipples, insufficient milk production, their infants were still feeling hungry after breastfeeding, misinterpretation of normal infants crying, infants comfort and ease with formula feeding, breast milk dried up and poor latching of baby at the breast). These findings were similar to the findings of Raffle who stated that pain of mothers had a negative impact

on breastfeeding decisions (Raffle *et al.*, 2011). The findings of the current study suggest that the mother needs to be advised on the best feeding positions to help and eliminate her painful symptoms. And perceived insufficient milk supply is a worldwide issue that women report for early discontinuation of EBF (Brand *et al.*, 2011).

In the present study, most of the mothers (86.1%) knew that breastfeeding is the superior nutrition for the baby. Similar findings were observed by Woldegebriel who found that almost all mothers considered human milk as the best milk for good child growth compared to cow's milk and/or formula milk (Woldegebriel, 2002). Only (38.7%) of mothers in our study knew that breastfeeding benefits the baby emotionally and increases bond between mother and baby, but most of the mothers (77.1%) agreed that breastfeeding protects the child from infection. In comparison to a study conducted on Egyptian mothers in Assiut City, about 79% of the participants knew that breast milk promoted bonding between mothers and child and protects child from diseases (Safaa *et al.*, 2012) (Mohamed *et al.*, 2012).

The current study also found that only (25.5%) of mothers knew the role of breast milk in brain development of the infant, while the majority of mothers (82.4%) knew its effect in protection against constipation and stomach upset. Low percentage of mothers (15.8%) knew that mothers who breastfeed tend to lose weight and protected from breast cancer and only (21.8%) knew that Babies suckling causes mother's uterus to contract and have contraceptive effect. This reflects insufficient knowledge regarding the benefits of breastfeeding especially to mothers. This was similar to Abul-Fadl *et al.* who reported that lower percentage of mothers in Upper Egypt knew about the protective effects of breastfeeding, particularly against breast cancer and the lowest level of knowledge was about the potential contraceptive effect of exclusive breastfeeding (Abul-Fadl *et al.*, 2012).

This study showed that most of the mothers (91.6%) said that bottle feeding affects digestive system of infants. This finding is similar to a study demonstrated that participants who encountered feeding problems with the formula milk reported constipation and sickness such as vomiting, diarrhea, colic, and regurgitation as the most common ones. The risk of constipation among formula-fed children is quite common and this has also been found in Italy, whereby the authors reported that there is a prolonged gastrointestinal transit in formula-fed infants and the stool consistency is hard compared to breastfed infants (F Savino et al., 2003). High percentage of mothers (78.4%) believed that formula feeding is expensive and may transit infection, more than half of mothers (64.5%) perceived that bottle feeding is less convenient during midnight and (47.6%) of mothers mentioned the absence of antibodies in formula feeding. A study demonstrated that formula feeding can be easily prepared but it lacks the antibodies that are found in the breast milk, expensive and gas and constipation producing and, in all cases, it cannot match the complexity of breast milk. In addition, asthma, atopic dermatitis and allergic rhinitis are widely associated with formula feeding rather than breast feeding (Perinat J (2017). So many disadvantages are reported for formula feeding and seem to be similar to previously reported cases (Pairman et al., 2006).

Results showed perception level about the disadvantages of bottle feeding among working women and housewives; Most working women (60.5%) think that bottle feeding loosening bond between mother and child, In converse; (11.6%) of housewives think that. Most of working women and housewives think that bottle feeding affecting digestive system (98.4% and 88% respectively).

Working mothers are more likely to end breastfeeding prematurely compared with non-working mothers (Centers for Disease Control and Prevention, 2008; Hendricks et al., 2006; Kimbro, 2006; Ogbuanu et al.,

2011; Ryan et al., 2006). In contrast to our study, baby age at weaning among working mothers was 19.11 months, while in housewives was 12.56 months. It is likely that working mothers who aim for prolonged breastfeeding are distinct in their socio-economic and educational backgrounds as well as their self-confidence and aspirations. They might also have different job prospects, with different working conditions and work flexibility, and different patterns of return to work and of maternity leave take-up. This has previously been observed in research looking at breastfeeding patterns in Scotland. Clearly, variables measuring social class or education are highly collinear, and are proxy measures for broader differences in human capital which nourish differences in breastfeeding trends (Dex, 2008; Skafida, 2009).

Conclusion

The study concluded that (22.6%) of the studied women had poor breastfeeding practice, illiterate/primary educated and women of low socio-economic class were more likely to have poor practice level (OR, 3.3; 95% CI, 1.71-6.35 and 2.67; 95% CI, 1.12-6.35 respectively). The most common barriers for exclusive breastfeeding were lactation problems (60%) and returning to work (24.2%).

Older women (OR, 1.1; 95% CI, 1.05-1.15) and working women (OR, 13.08; 95% CI, 7.37-23.22) had satisfactory knowledge about the advantages and benefits of breastfeeding for child and mother.

Recommendations

Develop successful awareness programs about the importance of exclusive breastfeeding should be directed for young, first-time mothers, less educated and women of low socio-economic class. There is need for improving strategies for maternal care during the antenatal and postnatal periods. Supporting working women in work place by providing nursery time, suitable nursery place and enough maternity leave period.

References

1. Abul-Fadl AM, Shawky M, El-Taweel A, Cadwell K, Turner-Maffei C (2012). Evaluation of Mothers' Knowledge, Attitudes, and Practice Towards the Ten Steps to Successful Breastfeeding in Egypt Breastfeed Med. Jun;7(3):173-8.
2. Alamirew MW, Bayu NH, Tebeje NB, Kassa SF (2017). Knowledge and attitude towards exclusive breast feeding among mothers attending antenatal and immunization clinic at Dabat health center, northwest Ethiopia: a cross-sectional institution-based study. Nurs Research and Practice; 3:1-9.
3. Al-Hreashy FA, Tamim HM, Al-Baz N, Al-Kharji NH, Al-Amer H, Al-Ajmi H, et al. (2008). Patterns of breastfeeding practice during the first 6 months of life in Saudi Arabia. Saudi Med J.;29(3):427-31.
4. Al-Shoshan AA (2007). Factors affecting mother's choices and decisions related to breast feeding practices and weaning habits. Pak J Nutr; 6:318-22.
5. Attanasio L, Kozhimannil KB, McGovern P, Gjerdingen D, & Johnson PJ (2013). The impact of prenatal employment on breastfeeding intentions and breastfeeding status at 1 week postpartum. *Journal of Human Lactation*, 29(4), 620-8.
6. Bai Y, & Wunderlich SM (2013). Lactation accommodation in the workplace and duration of exclusive breastfeeding. *Journal of Midwifery and Women's Health*, 58(6), 690-696.
7. Bhardwaj SL, Rathore MS, Paliwal A (2012). A study of breast feeding and neonatal care practices in some ethnic communities in periurban slums at Jaipur, Rajasthan. *Anthropologist*; 14:459-65.
8. Brand E, Kothari C & Stark M (2011). Factors related to breastfeeding discontinuation between hospital discharge and 2 weeks postpartum. *Journal of Perinatal Education*, 20 (1), 36-44.
9. Centers for Disease Control and Prevention (2008). Breastfeeding-related maternity practices at hospitals and birth center-United States, 2007. *Morbidity Mortality Weekly Report*, 57,621-625.
10. Creative Research Systems, (2014). Sample size calculator. 2012. Accessed 21 Sept 2014.
11. Dex S (2008). Millennium cohort study—Exploration of some distinctive results for Scotland. In: Scottish Government Social Research.
12. El Mouzan MI, Al Omar AA, Al Salloum AA, Al Herbish AS, Qurachi MM. (2009). Trends in infant nutrition in Saudi Arabia: compliance with WHO recommendations. *Ann Saudi Med.*;29:20-3. <https://doi.org/10.4103/0256-4947.51812>
13. Egypt Demographic and Health Survey (2014). Gartner LM, Morton J, Lawrence RA, Naylor AJ, O'Hare D, Schanler RJ (2012). Breastfeeding and the use of human milk. *Pediatrics*; 129: e8827-41.
14. Fida NM, Al-Aama JY. (2003). Pattern of infant feeding at a university hospital in Western Saudi Arabia. *Saudi Med J.*;24(7):725-29.
15. F Savino, F Cresi, S Maccario et al. (2003). "Minor' feeding problems during the first months of life: effect of a partially hydrolysed milk formula containing fructo- and galactooligosaccharides," *Acta Paediatrica*, vol. 91, no. 441, pp. 86-90.
16. Gartner LM, Morton J, Lawrence RA, Naylor AJ, O'Hare D, Schanler RJ (2012). Breastfeeding and the use of human milk. *Pediatrics*; 129:e8827-41.
17. Girish S, Gandhimathi M (2015). Primipara Mother's Knowledge, Attitude and Practice of Breastfeeding. *International Journal of Advanced Nursing Science and Practice*;2:41-48.
18. Hendricks, K, Briefel R, Novak, T & Ziegler P (2006). Maternal and child characteristics associated with infant and toddler feeding practices. *Journal of American Dietetic Association*, 106(1, Suppl. 1), S135-S148.
19. Kimbro R T (2006). On-the-job moms: Work and breastfeeding initiation and duration for a sample of low-income women. *Maternal and*

- Child Health Journal, 10, 19-26. doi:10.1007/s10995-005-0058-7.
19. Mohamed SA, Mohamed AG, Mohamed EM, Khaled EM (2012). Knowledge and practices of working mother about breastfeeding and weaning in Assiut city, Egypt. *Life Sci J.*; 9:803–8.
 20. Newcombe RG (1998). Two-sided confidence intervals for the single proportion: comparison of seven methods. *Stat Med.*; 17:857–72.
 21. Ogbuanu C, Glover S, Probst J, Hussey J & Liu J (2011). Balancing work and family: Effect of employment characteristics on breast-feeding. *Journal of Human Lactation*, 27, 225-238. doi:10.1177/0890334410394860.
 22. Otsuka K, Dennis C, Tatsuoka H, Jimba M (2008). The relationship between breastfeeding self-efficacy and perceived insufficient milk among Japanese mothers. *J Obstet Gynecol Neonatal Nurs*; 37:546–555.
 23. Pairman, S Pincombe J, Thorogood C, Tracy S (2006). *Review of Midwifery*: Elsevier, Sydney.
 24. Perinat J (2017). *Current research Continues to support Breastfeeding Benefits*. Lamaze International; 2001.
 25. Raffle H, Ware L, Borchardt A, and Strickland H (2011): *Factors that influence breastfeeding initiation and persistence in Ohio's Appalachian region*. Athens, OH: VoinovichSchool of Leadership and Public Affairs at OhioUniversity: Page 6/96.
 26. Ryan AS, Zhou W& Arensberg MB (2006). The effect of employment status on breastfeeding in the United States. *Women's Health Issues*, 16(5), 243-251. <http://www.sciencedirect.com/science/article/pii/S1049386706000880>
 27. Skafida V (2009). The relative importance of social class and maternal education for breastfeeding initiation. *Public Health Nutrition*, 12, 2285–2292.
 28. Woldegebriel A (2002). Mothers' knowledge and belief on breast feeding. *Ethiop Med J* 2002;40:365-74.
 29. World Health Organization (2011). *Exclusive breastfeeding for six months best for babies everywhere*. Geneva: World Health Organization.
 30. World Health Organization (2017). *Breastfeeding. Maternal child_adolescent*
 31. Yadav DK, Gupta N, Shrestha N (2013). Infant and young child feeding practices among mothers in rural areas of Mahottari district of Nepal. *J-GMC-N.*; 6(2):29–31.
 32. Young B (2016). The short and long-term benefits of breastfeeding. In: Saavedra J, Dattilo A, eds. *Early nutrition and long-term health: mechanisms, consequences, and opportunities*. 1st ed. Elsevier Publishing.