

Early Maternal Practices for Maintenance of Breast Milk Flow during Hospitalization of their High Risk Neonates: An Intervention Nursing Study

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Abstract: Background: Having high risk newborn in the Neonatal Intensive Care Unit (NICU), is disempowering for mothers as they lost autonomy over their own behavior and lost autonomy over beginning to establish a close relationship with their neonates. Breast feeding/breast milk feeding is highly valued by mothers as it is the 'one thing that only the mother can do to protect and improve their neonates' health. **Aim:** The aim of this study was to evaluate the effect of nursing intervention about early maternal practices for maintenance of breast milk flow during hospitalization of their high risk neonates on knowledge and practices of the mothers and continuity of breast milk flow during hospitalization and after discharge from NICU. This aim can be achieved through assessing the knowledge and practices of mothers regarding early practices for maintenance of breast milk flow during hospitalization of their high risk neonates , designing, implementing and disseminating an Arabic brochure for all studied mothers about early maternal practices for maintenance of breast milk flow during hospitalization of their high risk neonates. **Design:** A quasi-experimental study was utilized. **Setting:** This study was conducted at the Neonatal Intensive Care Unit (NICU) at Maternity and Gynecological Hospital affiliated to Ain Shams University Hospitals and El-Mataria Teaching Hospital in Cairo. **Sample:** A purposive sample composed of 40 mothers and their high risk neonates. **Tools:** 1. **Pre-designed Questionnaire Format by Interviewing;** to assess demographic characteristics of the studied mothers & their high risk neonates and assess mothers' knowledge regarding maintenance of breast milk flow during hospitalization of their high risk neonates. 2. **Medical Records:** to collect data about high risk neonates. 3. **Observation Checklists:** to assess studied mothers' practices regarding maintenance of breast milk flow during hospitalization of their high risk neonates. **Results** of the study revealed that after application of nursing intervention and brochure dissemination, the studied mothers showed significant improvement in their correct knowledge and competent practices. **Conclusion:** Application of nursing intervention about early maternal practices for maintenance of breast milk flow during hospitalization high risk neonates has a positive effect on the mothers' knowledge, practices and continuity of breast milk flow during hospitalization and after discharge from NICU. This study **recommended** that early health teaching nursing sessions about maternal practices for maintenance of breast milk flow during hospitalization of high risk neonates can be applied for all mothers in NICUs as a nursing intervention to improve their knowledge & practices and maintain their breast milk flow.

Key words: Breast milk, Breast milk expression, Breast feeding, High risk neonates, Milk production, Nursing intervention.

Date of Submission: 21-12-2018

Date of acceptance: 05-01-2019

I. Introduction

The World Health Organization (WHO) is recommended the exclusive breastfeeding (EBF) of infants during the first six months of life, and breastfeeding (BF) for two years or beyond with complementary foods for achieving optimal growth and health. In addition to providing essential nutrients to infants, breast milk has been shown to be related to decreased sudden infant death syndrome, respiratory-gastrointestinal tract infections, and allergic diseases, as well as a lower risk of developing obesity, cardiovascular disease, diabetes, and hematologic malignancies in future life (Yalcin et al., 2014) and (Yilmaz et al 2017).

Breastfeeding provides the perfect nutrition to newborns and infants, not only is it readily available and always at the right temperature, but also it helps promote bonding between mother and child and positively influences the infant's mental development. Current recommendations include exclusively breastfeeding through 6 months of age and then continuing to predominantly breastfeed (supplementing with water or water-based liquids) or partly breastfeed (adding in other liquids and solids) through 1 year or older (CDC 2014).

Breast feeding offering protection against hospital-acquired and other serious infections (such as necrotizing enterocolitis (NEC) and/or septicemia). Breastfeeding/breast milk feeding reduces mortality and provides the best nutritional support for such frail neonates (*Woodman, 2017*).

Breastfeeding has long been recognized for its benefits to infant and child health. Neonates and infants who are not breastfed are at increased risk of acute otitis media, gastrointestinal infections, necrotizing enterocolitis, and hospitalization for lower respiratory infections, sudden infant death syndrome (SIDS), leukemia, and obesity. Growing evidence also confirms the importance of breast feeding for the mother's own health. Breastfeeding for at least a full year over the course of a woman's lifetime is associated with a 28% reduction in her risk of ovarian cancer. Breast cancer has also been found to be lower the longer a woman breastfeeds. Analyses of the Nurses' Health Study have demonstrated a significant reduction in type 2 diabetes risk with each additional year of lifetime duration of breastfeeding. Breastfeeding is also associated with a reduced risk of postpartum depression (*Strawn et al., 2013*). It reduces all-causes and infection-related infant mortality, the effect of breast milk is dose-dependent, with exclusivity and longer duration increasing benefits (*American Academy of Pediatrics, 2012*), (*Chowdhury et al., 2015*) and (*Sankar et al., 2015*).

In many mothers of high risk neonates, the milk pathway begins with expression to initiate and build lactation. Due to their neurological immaturity, respiratory illness, and other medical complications, preterm neonates born less than 34 weeks may be unable to breastfeed initially and must instead rely on expressed human milk. Mothers may experience challenges initiating, building and maintaining lactation due to an immature stage of mammary development, the lack of high risk neonates' ability to feed, emotional challenges resulting from preterm delivery, and lack of access to appropriate equipment and timely support (*Medela, 2016*).

For premature infants, higher doses of human milk are associated with a lower risk of enteral feeding intolerance, late-onset sepsis, necrotizing enterocolitis, chronic lung disease, retinopathy of prematurity, neurocognitive delay, and re-hospitalization at 18 and 30 months of age (*Meier et al., 2012*). Breast milk can be provided to high risk neonates either directly through suckling at the breast (breastfeeding) or by having the mother express the breast milk with a pump and providing the milk via enteral feedings or bottle (breast milk feedings) (*PINEDA, 2006*). As mentioned by *Perrella et al., (2012)*, however, high risk neonates are breastfed for a shorter period of time compared with term infants, their mothers are more likely to struggle with the initiation, establishment, and maintenance of a sufficient breast milk production than mothers of term infants.

Being in hospital because of mothers' health issues, coupled with having high risk neonates in the NICU, was doubly disempowering for mothers as they lost autonomy over their own behavior and lost autonomy over beginning to establish a close relationship with their neonates (*Swanson et al., 2012*). Expressing breast milk contributed to mothers' healing while they felt guilty and blamed their bodies for delivering early. Mothers readily embraced 'pumping' as a chance to maintain their baby's health that had been interrupted by premature birth. Providing breast milk to high risk neonates also enabled mothers to renew the 'connection' that they felt with their fetuses during pregnancy (*Rossmann et al., 2013*). The difficulties experienced by mothers of high risk neonates as they persevere with providing breast milk for their neonates are compounded by feelings of loss and anxiety as staff may not have the knowledge, skills or time needed to support parents and their neonates in NNU in a truly person-centered way because of time pressures, established models of care and limited opportunities for training (*Woodman, 2017*).

According to *Sisk, (2010)* and *Swanson et al., (2012)*, the mothers' situation was compounded if they had pregnancy-related complications (such as pre-eclampsia) and side effects of medication reduced their understanding, this had a direct negative impact on their ability to follow early instructions about expressing breast milk. Mothers who were too ill to be with their neonates in the NNUs reported distress as they grieved for the normality of their pregnancy and the early motherhood that they had anticipated.

In Egypt, prematurity was a main reason for premature breastfeeding cessation, 27.3% of mothers in Upper Egypt, 27.4% in Lower Egypt, and 16.4% in Cairo stopped breastfeeding due to prematurity. Constant support is needed to reinforce education and ensure longer duration of breastfeeding (*Ahmed, 2007*). As mentioned by *Meier et al., (2012)*, the use of a hospital-grade electric pump with a double collection kit is recommended. To initiate lactation, mothers who are pump-dependent should use a hospital-grade pump with a pattern that mimics a newborn suckling pattern. This suckling pattern has been shown to increase removal of colostrum from the

breast, facilitate lactogenesis II, and increase milk production and maintenance of milk supply. Initiation of lactation via mechanical expression required the mother to pump every 2 to 3 hours with a goal of eight pumps per 24 hour period. Also, *Froh et al., (2015)*, stated that it is important that mothers pump right before sleep, at least once in the middle of the night, and first thing in the morning.

As mentioned by *Gephart and Weller, (2014)*, oral care for high risk neonates with human milk can be done. This should be done after each time the mother pumps around the clock until the infant can receive human milk by mouth. Oral care mimics what would occur with a healthy term infant feeding by breast. There are three primary rationales regarding the benefits of oral care for the infant: (a) human milk is a powerful antimicrobial agent and by coating the infant's mouth with milk a front-line defense is provided (b) human milk is a rich source of cytokines, and these cytokines may be absorbed through the infant's buccal mucosa, thus positively impacting the infant's immune system and (c) human milk has a sweet flavoring, therefore oral care with human milk provides a positive oral experience.

Also, *Coned et al., (2011)*, mentioned that, oral care with human milk may help to facilitate direct at-breast feedings. Skin-to-skin care is an essential component of NICU care that allows mothers to feel connected to their infants and has been demonstrated to improve breastfeeding outcomes. Prior to holding her infant skin to skin, the mother should completely empty her breasts. Skin-to-skin contact has been demonstrated to improve milk supply. In addition, skin-to-skin care is an important component of transitioning the infant from tube feedings to direct feedings at the breast. As a component of skin-to-skin care, non-nutritive sucking at the emptied breast during tube feeds can be initiated as soon as the infant is no longer ventilator dependent. According to *NANN, (2015)*, once the infant is receiving fresh milk feeds, milk can be stored for up to 96 hours in the refrigerator. Fresh milk feeds should always be prioritized to ensure the infant receives the maximal benefit and effect of the milk. If fresh human milk is unavailable, then frozen thawed milk should be used. Thawed milk must be used within 24 hours.

According to *Parker et al., (2012)*, neonatal nurses not only care for the newborn but also provide evidence-based support and care to the mother to ensure that mother establishes and maintains milk supply. Nursing education regarding milk production through pumping is important because lactation consultants are not always readily available. Nurses must assess milk supply daily during the first 1 to 2 weeks to ensure that maternal milk supply reaches full volume. Mothers should be instructed to pump within 1 hour of delivery, which has been correlated to early lactogenesis II and increased milk volumes at 1 and 3 weeks post-delivery.

Significance of the study

Breastfeeding is the nourishment designed by nature for neonates and infants. It represents the optimal form of nutrition for high risk neonates, including very and extremely preterm (*WHO, 2013*). Breast milk is the most perfect food for infants during the first few months of life; it provides the best nutrition for infant's growth and development and has an exclusive biological and emotional influence on the health of both mother and child (*Olang et al., 2012*) and (*Ghanbarnejad et al., 2014*).

Within the neonatal intensive care unit (NICU), there is an increased importance of human milk to protect preterm and high risk neonates. The NICUs environment presents unique challenges for mother- newborn breast feeding course. The reliance on breast pumps, delayed direct-breastfeeding and other NICU stresses may leave NICU mothers at an increased risk for decreasing or terminating human milk feeds prior to discharge (*Briere et al., 2015*). The transition to direct-breastfeeding may be associated with a variety of maternal and infant factors. In addition, environmental issues such as varying breastfeeding value and support in NICUs may explain differences in direct-breastfeeding rates (*Lucas et al., 2014*).

Aim of the Study

The aim of the current study was to evaluate the effect of nursing intervention about early maternal practices for maintenance of breast milk flow on mothers' knowledge & practices and maintenance & continuity of mothers' breast milk during hospitalization of their high risk neonates and after discharge. This aim can be achieved through, assessing the knowledge and practices of mothers regarding maintenance of breast milk flow, designing, implementing and disseminating Arabic brochure for studied mothers about maintenance of breast milk flow during hospitalization of their high risk neonates.

Research Hypothesis

The current study hypothesized that mothers who receive early nursing intervention of maternal practices about maintenance of breast milk flow will display improvement in their knowledge & practices and they will enjoy continuity, increasing and maintenance of their breast milk flow during hospitalization of their high risk neonates and after discharge.

II. Subjects and Methods

A. Research Design

The study design was a quasi-experimental.

B. Research Setting

The current study was conducted at the Neonatal Intensive Care Units (NICUs) at Maternity and Gynecological Hospital affiliated to Ain Shams University Hospitals, and El-Mataraia teaching hospital in Cairo, where the settings being of highest capacity of high risk neonates and also availability of mothers which helped the researcher to conduct the study.

C. Research Subjects

Sample Size and Characteristics: A quasi-experimental one group pre, post and follow up tests were used for this study. A convenience sample composed of all mothers who were available (40 mothers) at the time of study conduction and were voluntary willing to participate in the study and their high risk neonates were included in the current study.

Inclusion criteria for the studied mothers:

- Mothers of high risk neonates admitted to NICUs at the previously mentioned setting.
- Mothers who are willing to participate in the study.
- Mothers who are medically stable and able to attend the session of the nursing intervention.

Inclusion criteria for the studied high risk neonates:

- High risk neonates regardless of their gender.
- Gestational age ranged between 25-30 weeks
- Expected duration of hospital stay not less than 30 days.
- Present weight 1000-1250 gm.
- Physiologically stable and on intravenous fluids, total parenteral nutrition or by gavage feeding.

Exclusion criteria for the studied high risk neonates:

- High risk neonates whom were suffering from serious pathological conditions as necrotizing enterocolitis, intraventricular hemorrhage, acute stage of respiratory distress syndrome or pathological hyperbilirubinemia.
- High risk neonates with umbilical artery catheter, jugular or femoral venous catheter, thoracic or abdominal drainage
- High risk neonates with serious congenital anomalies as meningocele, meningomyelocele, skin problems or fluid intake restriction.

D. Tools of Data Collection

Data were collected through using the following tools:

I. Pre-designed Questionnaire Format by Interviewing:

It was designed by the researcher based on updated related literatures to assess demographic characteristics for mothers and their high risk neonates and mothers' knowledge regarding breast feeding and how to maintain breast milk flow during hospitalization of their high risk neonates it consisted of two parts:

Part 1: Characteristics of the studied subjects including: **A.** *Characteristics of the studied mothers such as;* maternal age, level of education, employment and parity. **B.** *Characteristics of the studied high risk neonates such as;* gestational age, birth weight, chronological age at study beginning, method of delivery, length, diagnosis, duration of hospital stay and medical diagnosis. These data were checked with the neonates' medical records.

Part 2: Questions regarding breast feeding and breast milk expression. It was adopted from *Department of Obstetrics and Gynecology, (2015)*, to assess mothers' knowledge regarding definition and benefits of breast feeding, factors that promote production of breast milk, factors that hinder production of breast milk, indications and benefits of breast milk expression, methods of breast milk expression, storage and using of expressed breast milk.

Mothers were interviewed individually or in groups that included 2-3 mothers according to their readiness and the questionnaire format was filled in by the educated mothers and by the researchers for illiterate ones. According to the answers obtained from the mothers, a **scoring** system was followed to obtain the outcome of mothers' knowledge (with excluding of maternal personal data). The total score for the questionnaire was 50 grades (equal 100%). The studied mothers' answer were checked using a model key answer and accordingly, their knowledge were categorized into; correct knowledge, 30 grades or more (scored 60% and more), and incorrect knowledge, less than 30 grades (scored less than 60%).

II. Medical Records: It was used to collect data about neonates' diagnosis, gestational age, birth weight, condition progress, feeding condition, weight gain and the general condition.

III. Observation Checklists:

It was adopted from *Ministry of Health and Population (2004) and Davis M. (2006)*, it was used to assess mothers' performance as regards hand washing, breast care, breast massage, breast milk expression and storage, transportation to hospital and using, first breast feeding for high risk neonate. Time consumed for assessing each procedure took 5-10 minutes. For **Scoring**, the total number of procedures was 8, each procedure scored from five (5) to fifteen (15) according to total number of steps for each procedure that made a total score of 50 grades (equal 100%) for all procedures. Accordingly, the scoring system of mothers' actual practices was classified into competent practices, 30 grades or more (60% and more) or incompetent practice, less than 30 grades (less than 60%).

A guiding brochure about maternal practices for maintenance of breast milk flow during hospitalization of their high risk neonates was prepared by the researcher using Arabic and English, national and international references. It was designed in a simple Arabic language to meet mothers' actual educational needs. The guiding brochure was evaluated for its content validity and clarity by 4 expert consultants of pediatric medical and nursing staff.

E. Phases of Study Application

1. Preparatory Phase

After reviewing the past and current regional and international related literature covering all aspects of the study using available books, journals, articles and magazines to get acquainted with the research problem and guide the researcher in questionnaire preparation and also in preparing a guiding brochure about early maternal practices for maintenance of breast milk flow during hospitalization of their high risk neonates that was designed in Arabic language.

- **Validity and Reliability:**

The tool was developed by the researcher. Tool was tested for its content validity by five experts in pediatric nursing field and its validity was 0.997. Reliability of tool was done by using Cornbach's alpha coefficient and reliability was 0.995.

- **Administrative Design**

An official approval was obtained to conduct the study from the hospital manager and head nurses in the previously mentioned study settings.

2. Exploratory Phase

A. Pilot study:

A pilot study was carried out on 10% of the studied sample, involved 4 mothers and their high risk neonates for the purpose of testing the tools, to determine its clarity, applicability, objectivity, time required to fill in each tool and feasibility of conducting the study. Simple modifications were carried out as revealed from the pilot study results to develop final form of the questionnaire and the subjects included in the pilot study were excluded later from the study sample.

B. Procedures technique

A. Setting the general objective of the sessions as follow:

Apply early maternal practices for maintenance of breast milk flow during hospitalization of their high risk neonates and after discharge.

B. The specific objectives of the sessions included the following:

- Gain over knowledge regarding definition and benefits of breast feeding.

- Discuss factors that promote or hinder production of breast milk.
 - List causes and benefits of breast milk expression.
 - Illustrate methods of breast milk expression.
 - Clarify storage and using of expressed breast milk.
 - Perform hand washing correctly.
 - Demonstrate breast care safely.
 - Perform breast massage correctly.
 - Apply breast milk expression, storage, transportation to hospital safely.
 - Manage first breast feeding for high risk neonate correctly.
- C. Educational content of the study:** According to the previously mentioned objectives, content of the intervention nursing study were included, definition, benefits of breast feeding, factors that promote production of breast milk, factors that hinder production of breast milk, causes and benefits of breast milk expression, methods of breast milk expression, storage and using of expressed breast milk. Practical techniques of hand washing, breast care and breast massage. Breast milk expression, storage, transportation to hospital and using. First breast feeding for high risk neonate.
- D. Selection of the Teaching Methods and Audiovisual Materials:** The following teaching methods/aids were utilized: mini lectures, group discussion, and simulation, demonstration and re-demonstration, posters, video films and power point presentations using researcher's Lap Top, as well as Arabic brochure were used as teaching media and instructional resources.
- E. Preparation of the equipment to apply early maternal practices for maintenance of breast milk flow during hospitalization of their high risk neonates.**

The researcher prepared the needed equipment that helped mothers to apply the content of the study such as hand soap, kidney basin, warm water, sterile gauze, sterile breast pump and bottle, small ice tank; two small manikins mimic 28 and 32 weeks preterm neonates and neonates' blanket. The researcher used mobile phone to provide the mothers with an album of simple photos and short videos for their high risk neonates to be watched immediately before and during milk expression at home to enhance milk production.

F. Field work

The actual field work was carried out from the beginning of August 2015 to the end of February 2016 for data collection and application of nursing intervention. The researcher was available 3 days/week in the morning shift at the allowed time of mothers' visit for their high risk neonates. The researcher carried out an initial visit for NICUs and introduced herself to the head nurse of the unit, explained the purpose of the visit and gave her a simple explanation about the nature of the study, its expected outcomes to the mothers and their high risk neonates.

After that, the researcher carried out an assessment for all the high risk neonates as regards gestational age, birth weight, chronological age, feeding condition, gaining weight, progress, changes, devices and treatment used for each case to select the study subjects fulfilling the study criteria.

For each group of mothers entailed 5-6 mothers, sessions were carried out in the hospital over a period of 2 weeks (6 sessions) 2 sessions for theory, 2 sessions for practice and 2 sessions for pre and posttest. The sessions of nursing intervention of the study were done in the mothers' feeding area in each neonatal unit of the previously mentioned settings.

- First educational session was for pretest.
- The second educational (theoretical) session covered some theoretical content highlighted an overview about definition and benefits of breast feeding and factors that promote or hinder production of breast milk.
- The third educational (theoretical) session included indications and benefits of breast milk expression, methods of breast milk expression, storage and using of expressed breast milk.
- The fourth educational (practical) session covered some practical content highlighted hand washing, breast care safely, breast massage.

- The fifth educational (practical) session included breast milk expression, storage, transportation of expressed breast milk to hospital safely, how to use it and how to manage first breast feeding for high risk neonate correctly.
- The sixth educational session was for posttest.
- The researcher explained all theoretical aspects of breast feeding and breast milk expression and revised it with mothers through group discussion at the end of each one of the theoretical sessions.
- The researcher demonstrated all practical parts for the mothers using real objects and instructed mothers to watch the previously obtained albums of simple photos and short videos for their own high risk neonates to be watched during breast care, massage and milk expression at home to enhance milk production.
- Mothers were encouraged to keep a diary on the frequency and duration of their breast milk expressions and volumes of expressed breast milk for the 24 hours, they were taught to accurately measure the volume of expressed breast milk by using graded sterile bottles.
- The researcher observed each mother individually during re-demonstration for all practical parts.
- At the end of each session the researcher summarized the content and feedback of the audience was emphasized.

G. Evaluation of the program

- The program was evaluated by re-observing mothers' practices immediately after the program and two weeks later at follow up (before discharge).
- The researcher used observational checklists tool to assess mothers' practices regarding breast feeding and breast milk expression.
- Duration and frequency of breast milk expressions and volume of expressed breast milk were measured daily pre and post the intervention program and at follow up.

H. Statistical Design:

Data were collected, organized, revised, coded tabulated and analyzed by using the Statistical Package for Social Science (IBM SPSS) computer program version 20 and Numerical data were presented as number, percentage, mean and standard deviations. The comparison between qualitative data pre and post application of nursing intervention was done by using *Chi-square* while quantitative data were compared using *Paired t-test*. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the p-value was considered significant as the following: P > 0.05 (Non-significant), P < 0.05 (Significant) and P < 0.01(Highly- significant).

I. Ethical Considerations

- An official permission was obtained. Permission from the studied mothers was obtained. Clear and simple clarification about the aim of the study was explained to all studied mothers. Mothers' participation was voluntary. The researchers ensured confidentiality of the studied mothers' personal data and the head nurses were informed about the nature of the study.
- Data related to the newborn infants such as their gestational age, weight, head circumference, length, diagnosis, etc... were extracted from the newborn's medical file and nurses' notes.

III. Results

Table (1): Distribution of the Studied Mothers According to Their Characteristics

Mothers' Characteristics	Studied Subjects [No. = 40 (100%)]	
	No.	%
Age (Years)		
< 20	10	25.0
20 - < 25	15	37.5
25 - < 30	5	12.5
≥ 30	10	25.0
$\bar{X} \pm SD$	28. 6 ± 6.2	

Level of education		
Illiterate	7	17.5
Read and write	5	12.5
Primary education	10	25
Secondary education	9	22.5
High education	9	22.5
Maternal employment status		
Employed	23	57.5
Unemployed	17	42.5
Family structure		
Nuclear	19	47.5
Extended	21	52.5
Mothers' Parity		
Nulliparous	23	57.5
Multiparous	17	42.5
Previous breast feeding Experience		
Yes	16	40
No	24	60
Previous Exclusive breast feeding (6 months)		
Yes	2	5
No	38	95

Table (1) showed that nearly two fifths (37.5%) of studied mothers' age ranged from 20 - < 25 years with $\bar{X} \pm SD = 28.6 \pm 6.2$. Regarding mothers' level of education, nearly one quarter (22.5%) of them were highly educated compared to 17.5% of them were illiterate. Also two fifths (40%) had previous breast feeding experience and the majority of them (95%) of them did not practice exclusive breast feeding.

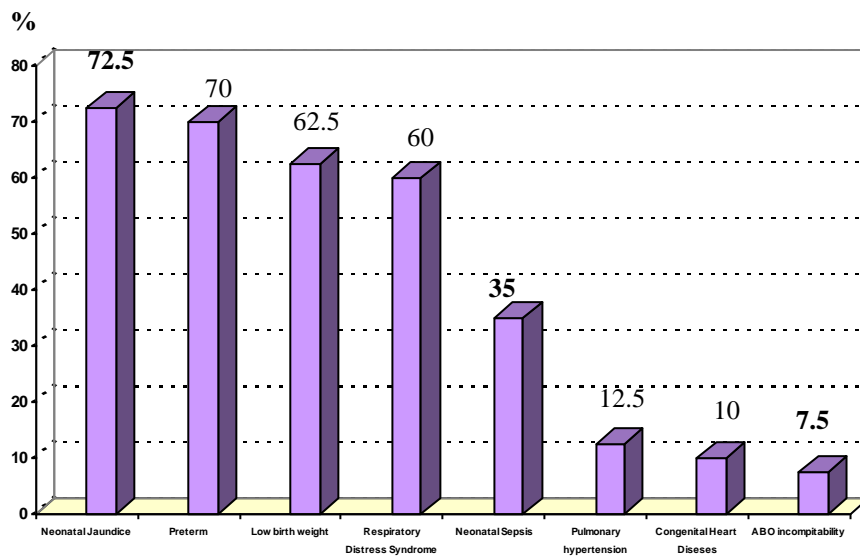
Table (2): Distribution of the Studied High Risk Neonates According to Their Characteristics

Neonates' Characteristics	Studied Subjects	
	[No. = 40 (100%)	
Gestational age (Weeks)		
< 26	2	5.0
26 - < 30	17	42.5
30 - < 34	21	52.5
$\bar{X} \pm SD$	32.5 ± 2.35	
Birth weight (Grams)		
< 1000	2	5.0
1000 - < 1500	24	60.0
1500 - < 2000	14	35.0
$\bar{X} \pm SD$	1650.35 ± 130.2	
Chronological age at beginning of study (Days)		
1 - < 5	21	52.5
5 - < 10	19	47.5
$\bar{X} \pm SD$	5.75 ± 0.56	

Type of delivery		
Normal Vaginal Delivery	18	45
Cesarean Section	22	55
Duration of hospital stay (days)		
20 - < 30	7	17.5
30 - < 40	13	32.5
40 - < 50	11	27.5
50 - ≤ 60	9	22.5
$\bar{X} \pm SD$	40.3±11.88	

As clarified from table (2) it was observed that, more than half (52.5%) of the studied high risk neonates their gestational age is 30 - < 34 weeks with $\bar{X} \pm SD = 32.5 \pm 2.35$. As regards their birth weight, it was found that 60.0% of the studied high risk neonates their birth weight ranged from 1000 - < 1500 grams. As well as, more than half of them (55%) were delivered by cesarean section with mean duration of hospital stay 40.3±11.88 days.

Figure (1): Percentage Distribution of the Studied High Risk Neonates according to their Medical Diagnosis



*Total number is not mutual exclusive

As regards diagnosis of the studied high risk neonates, figure (1) revealed that, the most common medical diagnosis was neonatal jaundice as observed in 72.5% of them, while ABO incompatibility was observed only in 7.5 % of them. Meanwhile neonatal sepsis (N.S) was found in more than one third (35%) of them.

Table (3): Distribution of Mothers' Correct Knowledge Regarding Breast Feeding pre / post Nursing Intervention and at Follow up.

Items of Knowledge	Mothers' Correct Knowledge (≥ 60%) [No.=40(100%)]			Test of significance	
	Pre	Post	Follow up	X ² 1	X ² 2
Definition of colostrum	3(7.5)	27 (67.5)	30 (75)	*28.90	4.90

				P = 0.000	P=0.027
Benefits of colostrum	4(10)	25 (62.5)	28 (70)	10.00 P = 0.002	2.5 P=0.114
Definition of Exclusive breast feeding.	4 (10)	32 (80)	37 (92.5)	*25.60 P = 0.000	*14.40 P=0.000
Ideal frequency of breast feeding/day.	7 (17.5)	32 (80)	30 (75)	*16.90 P = 0.000	14.40 P=0.685
Benefits of breast feeding for mother.	5 (12.5)	28 (70)	33 (82.5)	*22.50 P = 0.000	6.40 P=0.011
Benefits of breast feeding for neonate	3 (7.5)	25 (62.5)	30 (75)	*28.90 P<0.000	2.50 P=0.114
Obstacles of breast feeding for mother	6 (15)	28 (70)	31 (77.5)	*19.60 P<0.000	6.40 P=0.11
Obstacles of breast feeding for neonate	10 (25)	27 (67.5)	35 (87.5)	10.00 P= 0.002	2.50 P=0.114
Total Scores of Mothers' Correct Knowledge	9 (22.5)	33 (82.5)	34 (85)	12.10 P = 001	16.90 P=0.764

P<0.05= statistical significance, *P<0.001 = highly statistical significance, P>0.05= statistical insignificance. X² 1 = the difference between Pre and posttest, X² 2 = the difference between Post and follow up test.

As noticed from table (3), the majority of the mothers their total knowledge were correct regarding breast feeding post nursing intervention as observed in 82.5 % of them post nursing intervention compared to less than quarter (22.5 %) of them pre nursing intervention that reflected statistical significance difference (P = 001), while, insignificance differences was observed between post nursing intervention and at follow up (P= 0.764).

Table (4): Distribution of Mothers' Total Correct Knowledge Regarding Factors that Increase Breast Milk Production pre / post Nursing Intervention and at Follow up.

Items of Knowledge	Mothers' Correct Knowledge (≥ 60%) [No.=40(100%)]			Test of significance	
	Pre	Post	Follow up	X ² 1	X ² 2
Factors increase milk production	11 (27.5)	32 (80)	35 (87 .5)	*24.44 P<0.000	0.392 P=0.531

P<0.05= statistical significance, *P<0.001 = highly statistical significance, P>0.05= statistical insignificance. X² 1= the difference between Pre and posttest, X² 2 = the difference between Post and follow up test.

Table 4 indicated that, there was improvement in the total mothers' correct knowledge regarding factors that increase breast milk production as noticed in 80% post nursing intervention compared to 27.5 % pre nursing intervention that indicated highly statistical significance difference (P < 0.000). Meanwhile, insignificance difference was observed between post and follow up test (P=0.531).

Table (5): Distribution of Total Mothers' Correct Knowledge Regarding Factors that Inhibit Breast Milk Production pre / post Nursing Intervention and at Follow up.

Items of Knowledge	Mothers' Correct Knowledge (≥ 60%) [No.=40(100%)]			Test of significance	
	Pre	Post	Follow up	X ² 1	X ² 2
Factors inhibits milk production	9 (22.5)	31 (77.5)	30 (75)	*24.200 P=0.000	0.069 P=0.79

P<0.05= statistical significance, *P<0.001 = highly statistical significance, P>0.05= statistical insignificance. X² 1= the difference between Pre and posttest, X² 2= the difference between Post and follow up test.

Table 5 displayed that, there was a significant improvement in the majority of the total mothers' correct knowledge (77.5 %) post nursing intervention compared to pre intervention (22.5 %) regarding factors inhibits milk production with highly statistical significant difference (P < 0.000) that reflected the positive effect of the nursing intervention.

Table (6): Distribution of Mothers' Correct Knowledge Regarding Breast Milk Expression pre / post Nursing Intervention and at Follow up.

Items of Knowledge	Mothers' Correct Knowledge (≥ 60%) [No.=40(100%)]			Test of significance	
	Pre	Post	Follow up	X ² 1	X ² 2
Definition of breast milk expression.	8 (20)	32 (80)	37 (92.5)	*14.40 P = 0.000	*14.40 P=0.000
Indications of breast milk expression.	5 (12.5)	28 (70)	33 (82.5)	*22.50 P = 0.001	6.40 P=0.011
Benefits of breast milk expression.	3 (7.5)	25 (62.5)	30 (75)	*28.90 P = 0.000	2.50 P=0.114
Methods of breast milk expression.	2 (5)	28 (70)	31 (77.5)	*32.40 P<0.000	6.40 P=0.011
<i>Total Scores of Mothers' Correct Knowledge</i>	9 (22.5)	33 (82.5)	32 (80)	*12.10 P<0.001	16.90 P=0.673

P<0.05= statistical significance, *P<0.001 = highly statistical significance, P>0.05= statistical insignificance. X² 1= the difference between Pre and posttest, X² 2= the difference between Post and follow up test.

As revealed from table 6 there was improvement in the total mothers' correct knowledge regarding breast milk expression post nursing intervention as reported by 82.5% of them compared to pre (22.5%) nursing intervention that indicated highly statistical significance difference (P < 0.001). Meanwhile, insignificance difference was noticed between post and follow up test (P=0.673).

Table (7): Distribution of Mothers' Competent Practice Regarding Breast feeding and Breast Milk Expression pre / post Nursing Intervention and at Follow up.

Items of Practice	Mothers' Competent Practices (≥ 60%) [No.=40(100%)]			Test of significance	
	Pre	Post	Follow up	X ² 1	X ² 2
Hand washing.	8 (20)	32 (80)	37 (92.5)	*14.40 P=0.000	6.04 P<0.05
Breast care.	5 (12.5)	28 (70)	33 (82.5)	*22.50 P=0.000	6.40 P=0.011

Breast massage.	3 (7.5)	25 (62.5)	30 (75)	*28.90 P=0.000	2.50 P=0.114
Breast milk expression.	6 (15)	28 (70)	31 (77.5)	*19.60 P=0.000	6.40 P=0.011
Storage of expressed breast milk.	10 (25)	27 (67.5)	35 (87.5)	*10.00 P=0.002	4.90 P=0.027
Transportation of expressed breast milk to hospital.	4 (10)	30 (75)	28 (70)	*25.60 P=0.000	10.00 P=0.002
Using of expressed breast milk.	5 (12.5)	33 (82.5)	33 (82.5)	*22.50 P=0.000	16.90 P=1.000
Managing first breast feeding practice for high risk neonate.	6 (15)	25 (62.5)	35 (87.5)	*19.60 P=0.000	2.50 P=0.114
Total Scores of Mothers' Competent Practice	4 (10.0)	29 (72.5)	32 (80)	*25.60 P=0.000	8.10 P=0.004

P<0.05= statistical significance, *P<0.001 = highly statistical significance, P>0.05= statistical insignificance. X² 1= the difference between Pre and posttest, X² 2= the difference between Post and follow up test.

Table 7 clarified that, there was improvement in total mothers ' competent practices regarding breast feeding and breast milk expression post nursing intervention as reported by the majority (72.5%) of them compared to pre 10% nursing intervention that indicated highly statistical significance difference (P < 0.000).

Table (8): Mean Scores of Daily Mothers' Frequency Practice Regarding Breast Milk Expression, Breast feeding and Total Volumes of Expressed Breast Milk pre / post Nursing Intervention and at Follow up.

Items	[No. = 40 (100%)]			Test of significance	
	Pre	Post	Follow up	t 1	t 2
Frequency of Breast Milk Expression/ day	1.20± 0.405	5.32± 0.73	5.47±0.67	*18.73 P=0.000	46.14 P=0.806
Frequency of Breast feeding/ day	1.28 ±0.53	3.32±0.43	3.38±0.53	*12.63 P<0.001	0.044 P=0.833
Daily total Volumes of expressed Breast Milk/ml	25.62±8.63	230±25.46	245±14.60	*50.641 P<0.001	X ² =0.208 P=0.648

P<0.05= statistical significance, *P<0.001 = highly statistical significance, P>0.05= statistical insignificance. t 1= the difference between Pre and posttest, t 2= the difference between Post and follow up test.

As revealed from table (8), there was improvement in mothers' frequency of breast milk expression and breast feeding / day and daily total volumes of expressed breast milk post nursing intervention compared to pre nursing intervention that indicated highly statistical significance difference (P < 0.001).

IV. Discussion

As regards the age of the studied mothers (**table 1**), it was observed from the current study that, the mean age of mothers was 28.6±6.2 years. This finding was in contradiction with *Jihye & Kyung (2012)* who reported in a similar study that, the mean age of the studied mothers was 32.65±3.24 and 32.41±3.02 years in the experimental group and control one respectively. As regards level of education of the studied mothers (**table 1**), it was observed from the current study that nearly one fifth of the studied mothers were illiterate compared to nearly quarter of

them were highly educated. This means that whatever the educational level the mother, mother may experience high risk pregnancy and delivery. This findings supported with *Hidayat et al., (2016)*, who proved that, there was no significant correlation of educational level with preterm birth, there is no significant relationship between education and preterm birth, thus education is not perceived as a risk. These findings were supported with *Muthayya (2009)* , who mentioned in a similar study that maternal illiteracy and low socio economic standard have been shown to be major risk factors for intra uterine growth retardation in the developing world, lacking proper health systems and resources and the level of maternal education may be of prime importance in the determination of health outcomes of mothers and their infants and children.

In relation to the parity of the studied mothers (**table 1**), results of the current study proved that, more than half of mothers were nulliparous mothers, this result was inconsistent with *Bai et al., (2017)*, who reported in their study that, the majority of studied mothers were multiparous. In the same context, *Başer et al., (2013)*, proved in their study that, neonatal complications including low birth weight, low Apgar scores and NICU admissions were higher in nulliparous women. In relation to gestational age (GA) of studied high risk neonates (**table 2**), results of the current study showed that, the mean gestational age was 32.5 ± 2.35 weeks. This result was incompatible with *Héon et al., (2014)*, who mentioned in a similar study that, the mean GA of the studied neonates was 27.5 ± 1.7 weeks. This difference may be due to difference of study settings, sample size and research methodology.

In relation to the common diagnosis among the studied high risk neonates (**figure 1**), the current study findings showed that, the majority of the studied high risk neonates were suffering neonatal jaundice and prematurity. Meanwhile, the minority of them were suffering from congenital anomalies and ABO incompatibility. This may be due to the fact that LBW is a common characteristic of all high risk neonates and neonatal jaundice is one of their complications. These results were parallel with results of *Kotwal et al., (2017)*, who reported in their study that, the most common diagnosis among the studied high risk neonates was neonatal jaundice followed by neonatal septicemia.

On investigating mothers' knowledge regarding breast feeding (**table 3**), results of the current study proved that, less than tenth of the studied mothers had correct knowledge regarding definition of colostrum and only tenth of them had correct knowledge regarding benefits of colostrum before the nursing intervention that improved after nursing intervention with highly statistical significance difference that reflected the positive effect of the nursing intervention. This may be due to the fact that, more than half of the studied mother were nulliparous, also the sudden arrival of the high risk neonates deprives the mothers from prenatal health teaching and preparation regarding breast feeding. These finding were consistent with findings of *Sohail and Khaliq, (2017)*, who reported in their study that, more than quarter of mothers were discarding colostrum believing that colostrum is non-milk and more than four fifths of them thinking that it is non-nutritious and more than tenth of them thinking that it is causing diarrhea. In this context, *Joshi et al., (2012)*, and *LLLI, (2017)*, stated that, colostrum is bright yellowish thick milk secreted from mammary glands during late pregnancy and continuing during the first few days after birth. Colostrum is rich with immunoglobulin (IgA, IgG and IgM), enzymes, cytokines and growth factors. Along with that, colostrum also has laxative effects that help newborn to excrete the excess bilirubin and aid to pass the stool.

Concerning mothers' knowledge regarding exclusive breast feeding (EBF), (**table 3**), results of the current study proved that, only tenth of the studied mothers had correct knowledge regarding definition of exclusive breast feeding, where the majority of them were believing that exclusive breast feeding means providing breast feeding only for the first 2 months of infant's life combined with another soft food to fulfill nutritional needs. Also, less than fifth of them had correct knowledge regarding ideal frequency of breast feeding/day. Mothers in the current study reported that, newborn can be feed from 3-4 times/ day because neonates' little needs for feeding, and increased needs for sleep. Meanwhile, there was improvement of mothers' knowledge regarding the same items after application of nursing intervention compared to before intervention with highly statistical significance difference which reflected the positive effect of the nursing intervention. This may be due to the fact that, there was lack of mothers' health awareness and misconceptions inherited by generations about breast feeding which corrected through sessions of the nursing intervention.

These results supported by results of *Nukpezah et al., (2018)*, who reported in a similar study that the minority of the studied mothers practiced EBF.

These findings were in accordance to findings of *Uthkarsh, et al. (2015)*, who reported in a similar study that, the minority of the studied mothers had correct knowledge preprogram regarding concept of exclusive breast feeding which significantly improved after implementation of educational program. In the same context, *Rogers et al., (2011)*, mentioned that, exclusive breastfeeding from birth up to six months has many long term physiological and psychological effects on mother and child, and it reduces infant morbidity and mortality.

In the same line *Institute for Health and Welfare (2016)*, stated that, no specific nutritional guidelines for preterm infants exist, but exclusive breastfeeding is a primary diet for infants under six months and breastfeeding and breast milk expressing should be supported during the infant's hospitalization.

Regarding studied mothers' knowledge about benefits of breast feeding for both mothers and infants and obstacles of breast feeding, it was displayed from the current study that, most of the studied mothers were un aware and had incorrect knowledge about the previously mentioned items before the nursing intervention which improved after the nursing intervention with statistical significance difference, in the current study some of the mothers answered that they know from their mothers and relatives that breast feeding is important but they don't know why, this may be due to the fact that, more than half of them were nulliparous women so they had no knowledge or previous experience regarding these items. Also, in the normal pregnancy period, the last trimester is a time filled with great expectations and with physical and emotional effort and receiving knowledge from health care providers and relatives preparing for the birth. It is the time through which couple gradually moves toward becoming parents and mothers gradually seeking information and given health teaching regarding these items. The unexpected arrival of a preterm newborn deprives the parents of this gradual period of adjustment and preparation. These findings were incompatible with findings of *Roshan et al., (2018)*, who reported in a similar study that, All 100% knew about importance of breast feeding. This difference may be due to the difference of study settings and the characteristics of the study subjects.

On investigating mothers' knowledge regarding factors that increasing breast milk production (**table 4**), results of the present study showed that, the majority of the studied mothers' had incorrect knowledge regarding the previously mentioned items and majority of them had wrong concept that during admission of high risk neonates to NICU mothers should refrain from breast milk expression to retain the quantities of breast milk to be used for infant's feeding after discharge. Also, mothers had wrong concept to use pacifiers until milk supply is established.

These findings were mismatched with *Meier et al., (2012)*, who stated that, to initiate lactation, mothers who are pump-dependent should use a hospital-grade pump with a pattern that mimics a newborn suckling pattern. This suckling pattern has been shown to increase removal of colostrum from the breast, facilitate lactogenesis II, and increase milk production and maintenance of milk supply. In the same context, *Froh et al., (2015)*, mentioned that, initiation of lactation via mechanical expression required the mother to pump every 2 to 3 hours with a goal of eight pumps per 24 hours period, it is important that mothers pump right before sleep, at least once in the middle of the night, and first thing in the morning.

Furthermore, *NANN, (2015)*, recommended that, mothers should be provided with a target daily milk volume based on mature milk production in the healthy mother-infant dyad (440–1,220 milliliters). Early and frequent monitoring of milk supply during the first 2 weeks is critical to ensure that the mother will have an adequate supply at the time of the infant's discharge.

Concerning the total mothers' knowledge regarding factors inhibits milk production, (**table 5**) it was displayed from findings of the current study that, there was a significant improvement in the majority of the total mothers' correct knowledge post nursing intervention compared to pre intervention with highly statistical significant difference that reflected the positive effect of the nursing intervention. In the current study majority of studied mothers answered that, refraining from expression of breast milk does not affect the amount of breast milk flow after the newborn's discharge from NICU. Also, they unaware that, lack of maternal nutrition, physical and psychological relaxation has a direct negative effect on maternal health and consequently on breast milk flow.

In the same context *Henderson et al., (2016)*, mentioned that, women who experience delivery of high risk newborn are at increased risk of ill-health, anorexia, interrupted sleeping hours, depression and anxiety, poor psychological condition due to mother- newborn separation and lack of knowledge about consequences of high risk delivery and hospital admission of high risk newborn which negatively affecting on general health condition of the mothers and consequently breast milk production.

In the same line *Ikonen (2018)*, mentioned that the mothers' physical condition and fatigue, as well as worries over the infants and separation, impeded expression. Preterm birth can cause devastating and terrifying thoughts about infant survival. Mothers therefore perceived expression as an additional unwelcome demand at a period when they would have preferred to concentrate on their infants and their survival. As one mother described, "It felt horrible because the baby's life was in danger. The expression itself was a side issue." In addition, separation from their infants adversely affected the mothers, thus exacerbating the difficulties in expression and lactation

In relation to mothers' correct knowledge regarding breast milk expression (**table 6**), findings of the current study displayed that, the minority of the studied mothers had correct knowledge regarding all items concerning breast milk expression before the intervention study, which obviously improved after the nursing intervention and at follow up. This may be attributed to the frequently discussed items in the theoretical session and presence of the Arabic booklet with them. Before the intervention study, the researcher discovered that none of the studied mothers were transporting the EBM to the hospital in an iced state mistakenly thinking that it is better to be transferred in a fresh condition. Moreover, more than nine tenths of the studied mothers were believing that, the EBM must be discarded after expression because it is not suitable for newborn feeding once it is expressed.

These results supported with *Uthkarsh, et al., (2015)* who reported in a similar study that, majority (more than four fifths) of the studied mothers were not aware before the educational program about expressed milk, milk expression technique, storage and feeding of expressed milk which significantly improved after the educational program. In the same context *WHO, (2013)*, recommended that, all mothers must learn how to express their breast milk, so that mothers know what to do if the need arises.

These results were parallel with *Uthkarsh 2015*, who mentioned in a similar study that before the educational program on breast feeding promotion more than half of participants were not aware of importance of colostrum, frequency of feeding, ensuring adequacy of breast milk to the baby, and benefits to the mother because of breast feeding but in contrast many knew benefits of breast milk to the infant. Four fifths were unaware before the educational program about expressed milk, milk expression technique, storage and feeding of expressed milk which significantly improved after the educational program. These results were in agreement with results of *Héon et al.2014*, who proved in a similar study that, breast milk expression education and support intervention may be beneficial for the establishment and maintenance of an adequate breast milk production in mothers of high risk neonates.

In relation to mothers' competent practice regarding breast feeding and breast milk expression (**table 7**), findings of the present study showed that, there was improvement in the majority of total mothers' competent practices regarding breast feeding and breast milk expression post nursing intervention compared to pre intervention that indicated highly statistical significance difference. This may be due to the recurrent demonstration and re-demonstration with different teaching methods and instructional media beside the presence of the Arabic booklet with the mothers.

In the same line *Medela, (2016)*, mentioned that mothers are encouraged to pump, collect and store their milk for enteral or oral feeding, some of the essential components of milk may be jeopardized. Since the collection, storage and processing of human milk comes with risks of nutrient loss, volume loss and milk contamination, efforts must be made to minimize macro and micronutrient loss, while maximizing the volume of human milk available to the preterm infant. Furthermore, *Kent et al.,(2012)*, breast massage combined with breast pumping can increase the amount of milk expressed, in addition, warming the breasts during pumping has been shown to be comfortable and improve the efficiency of milk expression.

Proper positioning and latching of the nipples minimizes friction and pressure limiting sore nipples. New mother prerequisite satisfactory information on breastfeeding process to synergize the outcome of effective exclusive breastfeeding. Nurses should have sufficient knowledge on the technique and must to demonstrate

effective technique to primigravidas. Perinatal breastfeeding demonstrations and education must be introduced earlier at the antenatal clinic to prepare the new mothers for the reality ahead. All positioning methods should be habituated with assistance to pick out the most appropriate position at the ease of the baby and mother in natal and postnatal periods with constant follow ups. This aids sufficient milk flow and painless feeding facilitating exclusivity of breastfeeding amongst this vulnerable group (*Neupane et al., 2014*).

As regards mean scores of daily mothers' frequency practice regarding breast milk expression, breast feeding and total volumes of expressed breast milk pre / post nursing intervention (**table 8**), results of the current study revealed that, there was improvement in mothers' frequency of breast milk expression and breast feeding / day and daily total volumes of expressed breast milk post nursing intervention compared to pre nursing intervention that indicated highly statistical significance difference. These findings were parallel with *Kent et al.,(2012)*, who stated that, Frequent suckling by the newborn after birth has been shown to have a positive effect on subsequent milk production. Breast expression is an interim measure to boost milk supply while the infant develops the ability to transfer milk effectively.

Also, *NANN, (2015)*, stated that, instructing the mother to maintain a pumping log in order to monitor 24 hour milk production can be useful in assessing the need for modifications. NICUs should also consider development of a human milk management to optimize milk, ensure its safety, and minimize wastage of human milk.

V. Conclusion

Based on the findings of the current study, it was concluded that, nursing intervention about early maternal practices for maintenance of breast milk flow on mothers' knowledge had a positive effect on mothers correct knowledge and competent practices regarding breast milk expression after the nursing intervention and at follow up compared to before the intervention which support the positive effectiveness of the intervention nursing study.

VI. Recommendations

Based on the findings of the present study, the following recommendations are suggested:

1. Mothers who are expected to be at risk having high risk neonates in the NICU prior to delivery should receive tailored education regarding the importance of human milk and how to maintain breast milk and how is established during hospitalization and maintained after newborns discharge.
2. Efforts to improve breastfeeding need to be stepped up using all necessary tools including mass media to have the desired impact and promote breastfeeding.
3. All efforts should be made to include mothers of high risk neonates with low socioeconomic status in clinical trials, as they are more at risk for early breastfeeding cessation.

VII. References

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Dr. Mona Ali Kunswa Mohammed" Early Maternal Practices for Maintenance of Breast Milk Flow during Hospitalization of their High Risk Neonates: An Intervention Nursing Study". *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, vol. 8, no.01, 2019, pp. 26-37.