Effect of Breast Feeding Versus Formula Milk Feeding on the Preterm Infants in the Neonatal Intensive Care Unit at Tobruk Medical Center

(Original Research Article)

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Abstract

The effect of breast feeding versus formula milk feeding on growth and short-term outcomes among preterm infants in Neonatal Intensive Care Unit at Tobruck Medical Center. This is a case control study over 12 months period was conducted on 52 premature babies admitted in the nursery of Tobruck Medical Center from 1stJan. 2019 till 1stJan. 2020. All admitted preterm babies in the study period were enrolled(n=52) and divided according to feeding pattern into three groups (babies on exclusive breast milk(n=10), group on bottle milk (n=18)and third group on bottle and breast milk(mixed) (n=24) .These three feeding patterns were compared in terms of their effects on weight gain, Length of hospital stay (LOS), outcome, incidence rate of feeding intolerance, sepsis and incidence rates of complications. The study included 52 premature newborn ,29 males (55.8%) and 23 females (44.2%) with gestational age (GA) ranging (28-36weeks) and BW ranging (900-3.600 grams) and All newborns were Libyan with maternal age ranging(17-37 yrs.) were the Length of hospital stay LOS ranging (1-55days). The most common reported maternal diseases in this study were Urinary tract infection UTI (15,38%) followed by vaginitis and UTI (7,69%),other diseases (1.92%), but the majority 62% without (1.9%) newborn have distension ,1 (1.9) with gastric residual, 1 (1.9%) have poor sucking .Regarding the complication happen in preterm enrolled in this study 3(5.8%) complicated with anemia , apnea , 2 (3.8%) nosocomial infection , 1 (1.9%) jaundice ,1 (1.9%)

mixed complication ,were 34 (65.4%) not have complication. 92% of enrolled preterm discharged, 2% transferred and 6% died. We found no significant correlation between types of feeding and inflammation risk (C reactive protein CRP marker) .

Key Words: Breast Feeding; Premature; Formula Milk.

Introduction

Exclusive Breastfeeding (EBF) until the sixth month of life recommended by the World Health Organization (WHO) is the ideal food for promoting healthy growth and development, in addition it favors the sustainability and reduction of social inequalities (1,2). Preterm birth (PB) defined as childbirth occurring at less than 37completed weeks (WK) or 259 days of gestation, is a major determinant of neonatal mortality and morbidity and has long-term adverse consequences for health (3,4). Children who are born prematurely have higher rates of cerebral palsy (CP), sensory deficits, learning disabilities and respiratory illnesses compared with children born at term. The morbidity associated with preterm birth often extends to later life resulting in enormous physical, psychological and economic costs (5,6,7).

For Premature Newborn (PN), breast milk (BM) offers additional benefits such as lower incidence and severity of necrotizing enterocolitis (NEC), sepsis and retinopathy of prematurity (ROP), increased neuropsycholo-gical performance, strengthening of the mother-child bond, shorter length of hospital stay (LOS), and shorter incidence of readmissions (8). Additional benefit effects of BM are related to improvements in an infant's antibody, rich of nutrients, enteral tolerance, and better neurodevelopmental outcome and recommends for all newborn infants (9). During Premature newborn (PN) hospitalization period in Neonatal Intensive care Unit (NICU), their feeding method may need a change in cases such as low-volume milk feeding, taking complements with milk, or cessation of BM due to prolonged hospitalization. In these cases, feeding should be administered through another.

nutritional support in the first weeks after birth not only lead to a higher survival of Premature newborn PN and neonates in a very critical condition, but also facilitate their brain and neural development (11). Aiming to save children's lives, WHO developed a set of recommendations, including Exclusive breast feeding (EBF) up to six months and avoidance of bottle-feeding, safe complementary foods at six months and

supporting Various studies evidenced better cognitive development and intelligence quotients in breastfed infants compared to bottle-feed ones (12). Previous studies have shown that bottle-feeding was a key factor for child morbidity and mortality in different settings (13,14,15). This study aimed evaluate the importance and the effect of breast feeding on preterm infants with various gestational ages and difference in outcome , length of hospital stays LOS and complications regarding types of milk which not studied before in Tobruck City.

Materials and Methods

Study Design

A prospective case control study was performed in NICU at Tobruck Medical Center. All preterm infants with gestational age less than 37 weeks admitted to NICU from 1stJan.2019 until 1stJan.2020 enrolled in this study. This study includes all preterm newborns admitted in the nursery. Babies with congenital anomalies and died before 7 days of life was excluded. And newborn with 37 or more gestational age GA.

The Data was collected by using a designed perform direct questionnaire from mothers at admission by author himself as well as by reviewing the medical records of the babies which filled by resident doctors in the unit, detailed history including : demographic data of mothers and her babies was taken, gender, nationality GA, mode of delivery , age and nationality of mother ,blood group of mother and her baby and antenatal history of maternal diseases , types of milk, route of feeding, time of feeding initiation ,volume of 1st feeding, feeding intolerance and short term complications , examination including WT of babies on admission and discharge and general observation, laboratory and radiological data ,management and O2 therapy, Length of hospital stay LOS and outcome.

Ethical Approval

This study protocol was approved by the ethics committee of the Scientific Research in Tobruk University and patients were informed about the research and gave their verbal consent.

Results

The study included 52 premature newborn ,29 males(55.8%) and 23 females (44.2%) with GA ranging (28-36weeks) and Birth weight BW ranging (900-3.600 grams) as listed in table(1) and figure (3),All newborns were Libyan with maternal age ranging(17-37 yrs.) as showed in figure(1), were the and Length of hospital stay LOS ranging (1-55days).

Table (1): Demographic Data of Premature Newborn

No. %		**No. %**	**No. %**
Mean±SD		Mean±SD	
Gestational age in weeks		Gestational age in weeks	
32.10		32.10	
Birth weight by grams		Birth weight by grams	
Gender	1876.173	1876.173	1876.173
	No. %	No. %	No. %
Mode of delivery	Mean±SD	Mean±SD	Mean±SD
	Gestational age in weeks	Gestational age in weeks	Gestational age in weeks

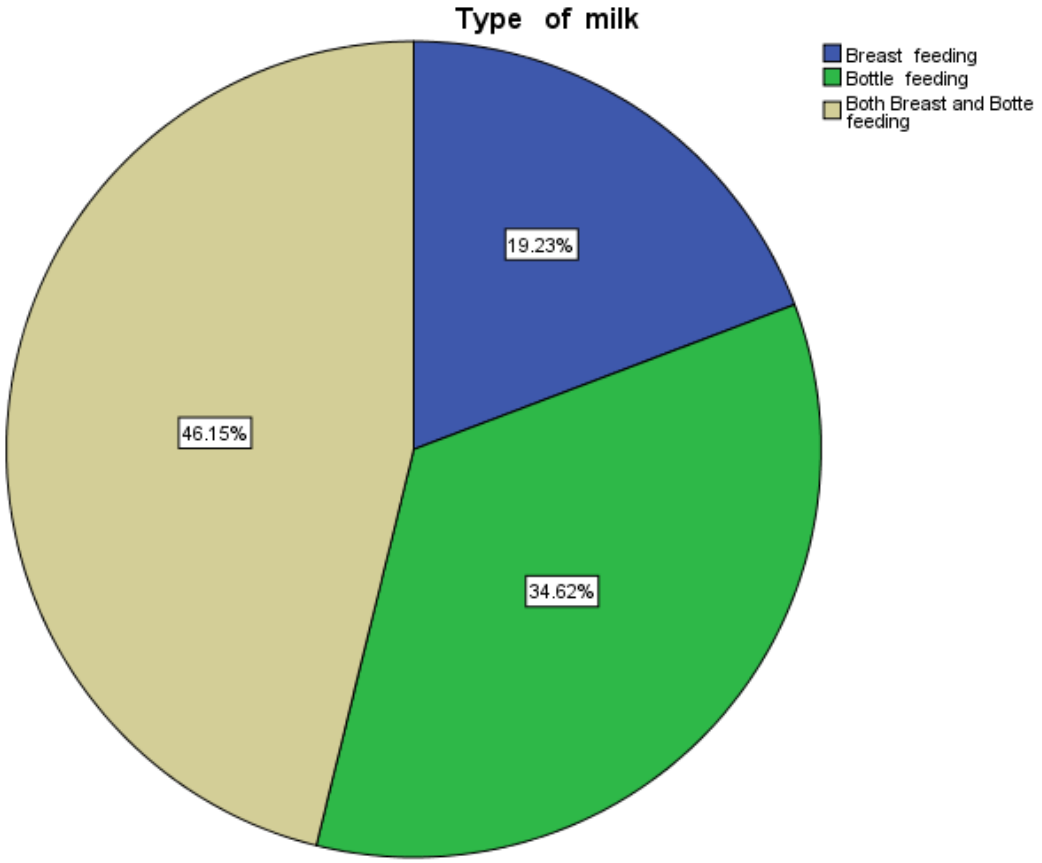

***Figure (1)**: Type of milk*

The total number of premature newborns were 52 where 10 (19.2%)newborn was on breast feeding and 18 (34.6%) on bottle feeding ,24(46.2%) was on mixed feeding

Table (2): Laboratory Data of Premature Newborns

Laboratory data	Minimum	Maximum	Mean ± SD
S(albumin)	1.5	4	3.21538±0.497990
ALK phosphatase	118	404	273.98± 60.493
Sodium	128	146	137.0904±4.34219
Potassium	3.5	6.7	4.7558±0.66197
Calcium	9	10.3	7.8404±1.33259
Urea	12	73	318942±12.85171
Creatinine	0.4	1.4	0.8038±0.20576
RBS	33	140	72.12±20.767
WBC	6.2	32	14.2519±5.83362
HCT	23	58	42.3706±8.18231
HB	6.3	19.8	145510±2.82407
PLT	56	398	228.63±75.720

Table (3): Complications among Studied Premature

Complication	NO.	Percent %
Anemia	**3**	**5.8%**
Apnea	**3**	**5.8%**
Nosocomial infection	**2**	**3.8%**
no complication	**34**	**65.4%**
Jaundice	**1**	**1.9%**
Anemia + NEC + Nosocomial infection	**2**	**3.8%**
Anemia + Apnea + BPD+ NEC + Nosocomial infection	**1**	**1.9%**
Apnea + NEC+ Nosocomial infection	**1**	**1.9%**
Apnea + Nosocomial infection	**1**	**1.9%**
Apnea + Convulsion	**1**	**1.9%**
Anemia + Jaundice+ Septic arthritis	**1**	**1.9%**
Anemia+ Nosocomial infection	**1**	**1.9%**
Anemia + Apnea	**1**	**1.9%**

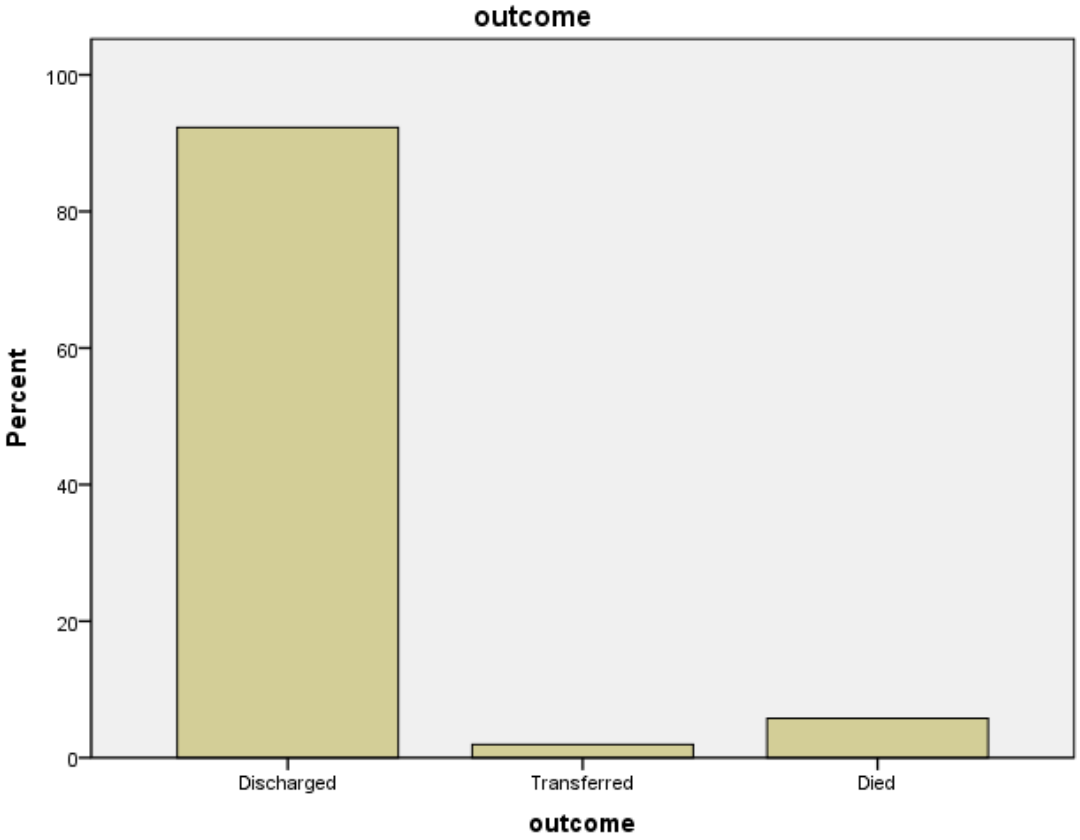

Figure (2): *Outcome among studied newborns*

The Outcome was 48 discharged (92.3%) ,1 transferred (1.9%) ,3 died (5.8%).

Table (4): Type of Milk and CRP

Type of milk	**CRP (C reactive protein) :**		
	Negative	**Positive**	**Total**
Breast feeding	6	4	10
Bottle feeding	15	3	18
Mixed feeding	18	6	24
Total	39	13	52

Table (5): Type of Milk and Weight on Birth

Type of milk	Birth weight groups			Total
	<1200g	(1200-2000g)	>2000g	
Breast feeding	3	6	1	10
Bottle feeding	1	7	10	18
Mixed feeding	2	12	10	24
Total	6	25	21	52

Table (6): Type of Milk and Weight on Discharge

Type of milk	Wight on Discharge Groups		Total
	(1200-2000g)	>2000g	
Breast feeding	8	2	10
Bottle feeding	8	10	18
Mixed feeding	11	13	24
Total	27	25	52

Table (7): *Type of milk and complications*

Complications	Type of milk			Total
	Breast feeding	Bottle feeding	Mixed feeding	
Anemia	0	1	2	3
Apnea	0	2	1	3
Nosocomial infection	0	0	2	2
no complication	7	13	14	34
Jaundice	0	1	0	1
Anemia + NEC + Nosocomial infection	0	1	1	2
Anemia + Apnea + BPD+ NEC + Nosocomial infection	0	0	1	1
Apnea + NEC+ Nosocomial infection	1	0	0	1
Apnea + Nosocomial infection	0	0	1	1
Apnea + Convulsion	1	0	0	1
Anemia + Jaundice+ Septic arthritis	0	0	1	1
Anemia+ Nosocomial infection	1	0	0	1
Anemia + Apnea	0	0	1	1
Total	10	18	24	52

Table (8): Type of milk and LOS

Type of milk	LOS Groups		Total
	1-7 days	more than 7 days	
Breast feeding	4	6	10
Bottle feeding	12	6	18
Mixed feeding	8	16	24
Total	24	28	52

Table (9): Time of feeding initiation and LOS

Time of feeding initiation	LOS Groups		Total
	1-7 days	more than 7 days	
1	3	0	3
2	14	2	16
3	5	7	12
4	2	7	9
5	0	2	2
6	0	5	5
7	0	3	3
8	0	1	1
10	0	1	1
Total	24	28	52

Table (10): Time of feeding initiation and outcome

Time of feeding initiation	Outcome			Total
	Discharged	Transferred	Died	
1	3	0	0	3
2	15	0	1	16
3	10	0	2	12
4	9	0	0	9
5	2	0	0	2
6	4	1	0	5
7	3	0	0	3
8	1	0	0	1
10	1	0	0	1
Total	48	1	3	52

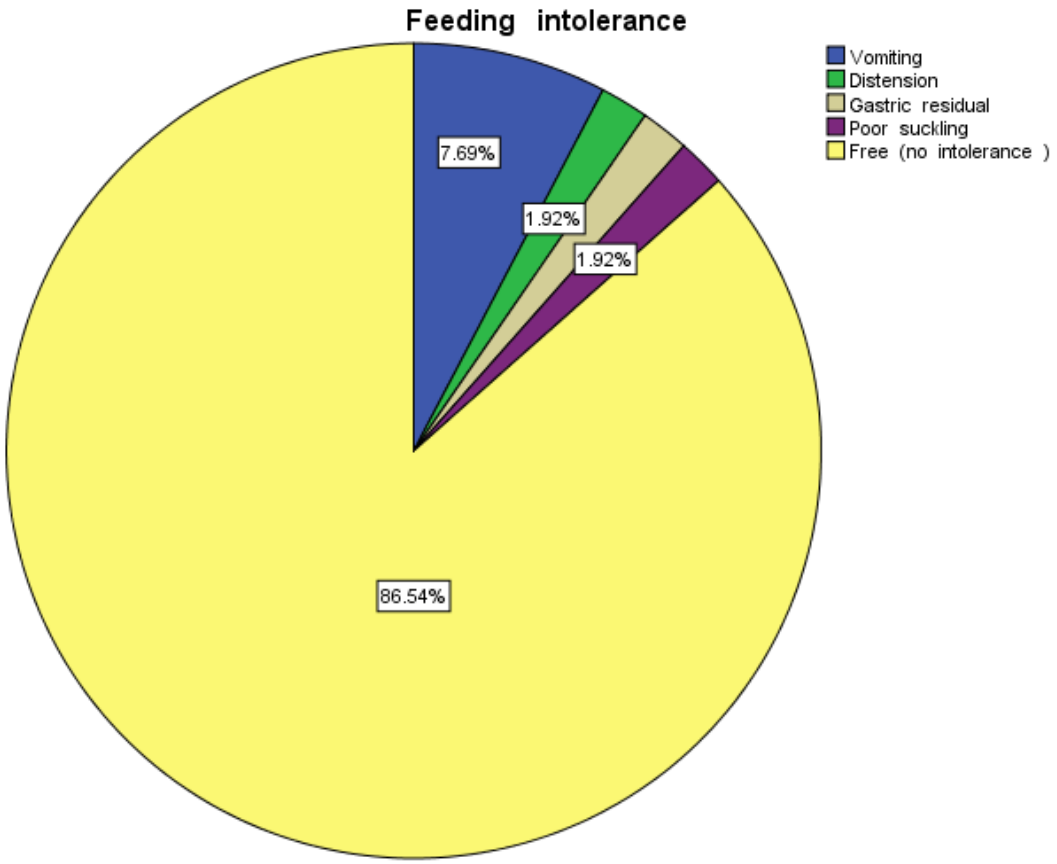

Figure (3): *Feeding intolerance*

Regarding feeding intolerance 45 (86.5%) newborns were not have intolerance ,4 (7.7%) developed vomiting and 1 (1.9%) newborn have distension ,1 (1.9) with gastric residual ,1 (1.9%) has poor sucking .

Discussion

This is a prospective study over 12 months period was conducted on 52 premature babies admitted in the nursery of Tobruck Medical Center from 1st Jan. 2019 till 1st Jan. 2020. The study included 52 premature newborn, 29 males (55.8%) and 23 females (44.2%) with GA ranging (28-36weeks) and birth weight ranging (900-3.600 grams). All newborns were Libyan with maternal age ranging (17-37 yrs.) and the Length of hospital stay LOS ranging (1-55 days).

The most common reported maternal diseases in this study were Urinary tract infection UTI (15,38%) followed by vaginitis and Urinary tract infection UTI (7,69%), other diseases (1.92%), but the majority 62% without any disease. While Leung T.N., et al. (16). found that hypertensive disorders of pregnancy, gestational diabetes, antepartum

hemorrhage, and congenital malformations were significant risk factors for spontaneous preterm labor.

Regarding type of feeding of studied preterm there were 10(19.2%) newborn was on breast feeding and 18 (34.6%) on bottle feeding, 24(46.2%) was on mixed feeding. Regarding of milk formula type 40 (76.9%) newborn was on premature milk formula and 2(3.8%) on full term milk formula while 10 (19.2%) newborn was on breast milk. The time of feeding incitation was range (1^{st} -10^{th}), mean 3.58± 1.954 SD days and volume of 1^{st} feeding ml/kg (3-10), mean 5.79 ± 2.304 SD.feeding intolerance reported as 4 (7.7%) developed vomiting and 1 (1.9%) newborn have distension ,1 (1.9) with gastric residual .

The laboratory data different from premature newborn to other where s. albumin was range (1.5-4) ,ALK Ph (118-404) ,Na(128-146) , K (3.5-6.7),Ca (9-10.3),BUN (12-73), Cr (0.4-1.4) ,RBS (33-140) , WBC(6.2-32),HCT (23-58),HB (6.3-19.8),PLT was range (56-398). Regarding the complication happen in preterm enrolled in this study 3(5.8%) complicated with anemia, apnea, 2 (3.8%) nosocomial infection, 1 (1.9%) jaundice ,1 (1.9%) mixed complication ,were 34 (65.4%) not have complication. 92% of enrolled preterm discharged, 2% transferred and 6% died. We found no significant correlation between types of feeding and inflammation risk (CRP marker) with p-value = .393 like Zhongguo Dang et al. (17) and Liyw et al. (18) that found no difference in nosocomial infection incidence in both bottle- and breast-feeding group. This disagrees with Beijing Da et al. (19). That showed decrease the incidence of sepsis with breast feeding group and feeding intolerance. Also, three observational studies one non-randomized trial (20), one interrupted time series (21) and one cohort study (22), there was a possible reduction in late onset sepsis with EBF unlike our result.

Our study results are showing the higher mortality was happen in breast feed newborns. While the bottle feeding, and mixed feeding groups of preterm newborns discharged without any mortality. So, there is strong correlation between types of feeding and outcome with P- value= .001 In O'Connor DL, et al. (23) was found the growth to be inversely proportional to the consumption of human milk. However, assessment of neurological development revealed that infants fed Maternal milk (MM) showed a better performance and Researchers have shown that, among preterm infants, breastfeeding provides better health outcomes for both the infant and mother (24,8,25).

Other studies that compared breastfed neonates and neonates receiving a milk formula also showed a better weight (WT) gain among those fed a formula, although without any beneficial effect on neurological development (26,27).

While our study found weight WT gaining more with both mixed and bottle feeding than breast feeding and there is no significant correlation in our study between type of milk and weight WT gaining with p value = .141 and our study didn't assist the neurological development of newborns. This result like a review published in 2014, British investigators who analyzed 9 trials comparing the risks and benefits of feeding preterm low birth weight babies with maternal milk MM from donors or with infant milk formula observed greater weight gain, length, and head circumference in the group of infants receiving formula during hospitalization (8).

Other studies did not observe greater weight and length gain among premature babies receiving a formula, with results un similar to those detected in the present study. with no significant differences in weight gain in infants fed MM compared to infants receiving a formula maayan- metzger A,et al.(28) & Cristofalo et al.(29) while Carlson 1998 (30) found higher weight gain with EPTF versus EBF over the time periods 15–35 days and 57 days to term, ,In contrast, Manea A,et al. (20) reported greater weight gain (g/d) in the Exclusive breast feeding EBF group during the first five weeks of life. Quigley M, et al. (8) noted, the risk of occurrence of Necrotizing enterocolitis NEC was higher in bottle feeding group of infants. And a review study conducted on 400 preterm babies with a GA≤30 weeks observed a lower prevalence of Necrotizing enterocolitis NEC and ROP(28) Also during hospitalization, human milk feeding is related to less occurrence of Necrotizing enterocolitis NEC, sepsis and Urinary tract infection UTI, decreased gastric pH, increased gastrointestinal motility, accelerated mucosal immunity, improved gut microflora, and decreased mucosal permeability leading to reduced bacterial translocation. The benefits of human milk remain after discharge as they improve indexes of neurodevelopment that persists into adolescence, avoiding obesity, precocious puberty and other problems (31,32).The observational studies show there is a possible reduction in any Necrotizing enterocolitis NEC with Exclusive breast feeding EBF compared with Exclusive premature formula EPTF ,two cohort (21,33) and one non-randomized studies (20) reported this comparison for any NEC. Observational studies have found higher rates of Necrotizing enterocolitis NEC in infants fed formula compared with MM B (Battersby 2017) (34).

Meta-analysis of data from randomized controlled trials indicates that feeding with formula, compared with donor breast milk, leads to higher rates of feed intolerance and Necrotizing enterocolitis NEC in preterm infants (QuigleyM) (8). Also has been reported by [24,35 ,36 ,23]. that premature infants who are breastfed have lower incidence of Necrotizing enterocolitis NEC and late-onset sepsis and they have better feeding tolerance and neurodevelopmental outcomes. All these results agree with our results as we found the NEC happen more in bottle and mixed formula feeding groups rather than breast milk group Although complication in our study less occur with newborn on breast feeding. Our study results are showing the higher mortality was happen in breast feed newborns. While the bottle feeding, and mixed feeding groups of preterm newborns discharged without any mortality. So, there is strong correlation between types of feeding and outcome with P- value= .001 We found that there is no significant correlation in this study between the gender of preterm babies and outcome.

The complications in our study less occur with newborn on breast feeding, while Zhongguo Danget al. (17) and Li YW et al. (18) found no difference in breast- and bottle-feeding groups regarding complications. We found no significant correlation in our study between type of milk and Length of hospital stay LOS with p value = .091. like (17) and (18) found no difference in Length of hospital stay LOS in both bottle and breast feeding premature with GA 28-30 weeks and 34-36Ws, while decrease of Length of hospital stay LOS in breast feeding premature with GA 31-33Ws. Increase in weight WT in low-birth-weight LBW and Very low birth weight VLBW Infants Fed Fortified Breast Milk versus Formula Milk: A Retrospective Cohort Study Lok, K., et al. (37). Observed differences seen could also be due to a reverse causation effect because mothers of more fragile infants are more likely to breastfeed owing to the potential benefit of better recovery; therefore, these infants could have longer lengths of stay and more parenteral feeding days. Thus, Length of hospital stay LOS and parenteral feeding days are not causally related to breast milk feedings. Our study results are showing the early oral feeding initiation decrease length of hospital stay LOS, so there is strong correlation between time of feeding initiation and LOS with p value = .001 We conclude no significant correlation between time of feeding initiation and outcome in studied premature with p value =.630

We noted no significant correlation in this study between feeding intolerance and outcome in premature babies with p value = .009 While (17) and (18) found the

breastfeeding group had a significantly faster increase in body wight wt, a significantly lower incidence rate of feeding intolerance.

Conclusion

The main result of this study was finding the effect of breast feeding versus Formula Milk Feeding on growth and short-term outcomes among preterm infants in Neonatal Intensive Care Unit at Tobruck Medical Center. We conclude no significant correlation between time of feeding initiation and feeding intolerance and gender and outcome in premature babies . We found a strong correlation between types of feeding and outcome and fewer complications happen in premature babies on breast milk.

We conclude that the early oral feeding initiation decrease Length of hospital stay LOS in preterm babies. And more weight gain among bottle and mixed bottle and breast feeding rather than exclusive breast feeding. Prevention of prematurity is the main goal, so a better understanding of the high-risk groups is required to improve care and encouraging of early and continuous breast milk feeding for all premature newborns is the main target in our NICU.

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