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Early versus Late Trophic Feeding: Effect on Health Status of Low Birth Weight Neonates

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Abstract
This study aimed to compare the effect of early versus late trophic feeding on the health status of low birth weight neonates. A comparative descriptive design was utilized on a convenience sample of one hundred low birth weight neonates, fifty of them for early group trophic feeding and the other fifty for late feeding. Sample was collected from two NICUs in Cairo University Hospitals from May 2013 till February 2014 to answer the research question" Does health status of low birth weight (LBW) neonates who start early trophic feeding better than those who started late trophic feeding?" Three tools were developed by researchers: socio-demographic data, nutritional recording sheet and observational check list for feeding tolerance signs and it filled by researchers daily for every neonate from admission till discharge. Results revealed that there were no statistically significant differences in the clinical and maternal characteristics of neonates in the two groups. The birth weight was increased significantly for early group than late in the 1st, 2nd and 3rd week. Amount of parenteral nutrition, hospital stay significantly less in early compared to late feeding group; late group experienced a highly significance incidence of milk intolerance and infection signs in the first week only. The benefits of early trophic feeding shown by this study strongly support its use for the LBW neonates. Early trophic feeding must be encouraged for all low birth weight neonates were recommended.
Keywords: Early, Late Trophic Feeding, Health Status, Low Birth Weight Neonates

1. Introduction:

Early trophic feeding, giving neonates very small volumes of milk during the first week after birth, may promote intestinal maturation, enhance feeding tolerance and decrease time to reach full enteral feeding independently of parenteral nutrition (Bisquera, Cooper & Berseth, 2007, and Kennedy, Tyson & Chamnanvanikij, 2009). The introduction of enteral feeds for low birth weight (LBW) neonates are often delayed due to concern that early introduction may not be tolerated and may increase the risk of necrotizing enterocolitis. However, enteral fasting may diminish the functional adaptation of the immature gastrointestinal tract and prolong the need for parenteral nutrition with its attendant infectious and metabolic risks (Bombell & McGuire, 2009).

Advanced neonatal cares, improved survival of preterm neonates and necessity of providing adequate nutritional regimes has made feeding strategies as one of the major clinical challenges facing NICU staff (LaGamma & Browne, 1994 and Thureen, 1999); because of excess prematurity, very low birth weight preterm neonates are not often able to be directly breast fed and prolonged parenteral nutrition will predispose them to sepsis and phlebitis (Davey, Wagner & Cox, 1994 and Berseth & Nordyke, 2008).

Beneficial effects of human milk in improvement of host defense, digestion and absorption of nutrients, neurodevelopment, gastrointestinal function as well as psychological effects (Schanler, 2011), makes it suitable for meeting essential needs of premature neonates; whereas enteral feedings in very low birth weight or sick preterm neonates are often delayed for several days or weeks after birth because of respiratory compromise or risk of necrotizing enterocolitis (Williams,1997); fortunately wisdom of withholding enteral nutrition in preterm neonate has been questioned from last 3 decades. Among practiced feeding strategies, trophic feeding which is early initiation of enteral feeding along with parenteral nutrition seems to be the solution (McClure & Newell, 2012); improved feeding tolerance, less need of parenteral nutrition, more mature intestinal motility patterns (Berseth & Nordyke, 2008 and Tyson& Kennedy 2009), increased growth rate, bone mineralization, stable biochemical measures of nutritional status, improved mineral homeostasis, better calcium and phosphorus retention, higher serum calcium and alkaline phosphates activity, and shorter intestinal transit times have been reported following trophic feeding versus parenteral nutrition (Schanler, Shulman & Lau, 2011).These beneficial effects, in turn, could be associated with a significant economic advantage if they reduce the duration of hospitalization (Bisquera, Cooper & Berseth, 2007).

Although several studies have verified the potential benefits of trophic feeding, there is no general agreement about the optimal timing to start enteral feeds (Bisquera, Cooper & Berseth,2007 and Tyson &Kennedy 2009 and Kliegman, Behrman & Stanton, 2011) A systematic review of Cochrane data base

revealed that only time to full enteral feeding, number of days that feedings were withheld and total hospital stay were significantly reduced following trophic feeding (Tyson & Kennedy, 2009) but there is still uncertainty about the exact time of starting minimal enteral feeding; another review assessed all studies of parenterally fed low birth weight preterm neonates to determine the effects of early enteral feedings initiated shortly after birth compared to delayed enteral feedings (Kennedy Tyson &Chamnanvanikij, 2009).; results of two included studies in analyses (Khayata, Gutcher & Bamberger,1987 and Davey, Wagner & Cox,1994) revealed that early feeding had no significant effect on weight gain, necrotizing enterocolitis, mortality, or age at discharge, although important effects cannot be excluded with the small number of patients studied. Bombell & McGuire, 2009 in their review wield that early trophic feeding did not provide any evidence to affect feed tolerance or growth rates in VLBW neonates. Considering all these results benefits and hazards of early versus delayed initiation of enteral feedings in parenterally fed preterm LBW neonates have received very little study, and the effects on major clinical outcome remain uncertain (Kennedy, Tyson & Chamnanvanikij, 2009 and Bombell & McGuire, 2009)
The aim of this study was to compare the effect of early (< 48 h) versus late (> 72h) trophic feeding on the health status of low birth weight neonates: time to regain birth weight, amount of parenteral nutrition, duration of hospital stay and feeding tolerance.

2. Significance of the study:

The absence or lack of enteral nutrients is associated with diminished intestinal growth, atrophy of intestinal mucosa, delayed maturation of intestinal enzymes, and increase in permeability and bacterial translocation, affects intestinal motility, perfusion, and hormonal responses. It is possible that a prolonged delay in starting feeds in low birth weight neonates may be partly responsible for the common problems of feeding intolerance encountered in these newborns (Levine, Deren, Steiger & Zinno, 1974). Trophic feeding is almost being initiated during the first week of life at the NICUs of Pediatric University Hospital (El Monira Hospital) and El Manial University Hospital (Kasr El Aini), but there is no study done in the two settings on the exact time to start trophic feeding for low birth weight neonate.

3. Aim

To compare the effect of early versus late trophic feeding on the health status of low birth weight neonates.
Operational Definitions of Health status:
It includes the infant's weight gain, duration of parenteral nutrition, duration of hospitalization, feeding tolerance, gastric residual volume and occurrence of sepsis.

4. Research question:

Does health status of low birth weight neonates who start early trophic feeding better than those who started late trophic feeding?

5. Material and methods

5.1. Research design
Comparative descriptive design was applied to achieve the aim of the study.

5.2. Setting
The proposed study was conducted at two setting at the neonatal intensive care units in Pediatric Cairo University Hospitals. Both units apply the same protocol of trophic feeding.

5.3. Sample
Sample size was estimated based on the information derived from pilot study with a type I error of 0.05 and a power of 0.90%.A convenience sample of 100 low birth weight neonates were included in the study. According to the neonates condition and physician order the trophic feeding was started early or late feeding. It was divided equally to two groups early and late trophic feeding. Neonates with any congenital anomaly were excluded. The study was approved by Ethics Committee of Nursing Faculty-Cairo University.

5.4. Tools for data collection
Three tools were developed by the researchers after reviewed the related literature
Tool I: Neonates and their mother's characteristics.
Tool II: Nutritional follow-up sheet, which includes weight and amount of parenteral nutrition.
Tool III: Observational check list, which include: signs of feeding tolerance and sepsis.

5. 5. Data Collection Procedures

Trophic feeding is almost being initiated during the first week of life; neonates with major congenital birth defects, severe asphyxia and referred from other hospitals did not meet the inclusion criteria. All neonates were daily visited until discharge.

Feeding Protocol in Egypt: Daily feeding order was maintained at each low birth weight neonate's file. Milk advancement and use of parenteral nutrition were consistent for all study neonates to provide similar intakes of fluid and energy. Bolus feeding was the common feeding method. Nasogastric Feeding tube (Radio-opaque feeding tube 2×47mm), was placed by the nurse and was not removed between feeds (changed daily); a syringe positioned above the neonate to administer feeds, and milk was administered by the law of gravitation. To measure the gastric tube length, we placed the tube tip at the xiphisternum and measured to the ear lobe and then to the mouth for nasogastric tubes. The neonates in each group received begin at a volume of 1-2 cc/kg of human milk or preterm infant formula every 6 hrs for the first 2 days, then 1-2 cc/kg every 4 hrs for another 2 days, and then advance slowly to reach 10-20 ml/kg/day divided into equal aliquots and administered by gavage feeding every 3-6 hrs as slow bolus feeds.

Before conducting the study an official permission was obtained from the director of El Monira Hospital and El Manial University Hospital to conduct the study. Starting trophic feeding early or late depend on their health condition and doctor order. One hundred LBW neonates met the inclusion criteria were included either in early group (50 neonates) or late group (50 neonates).

The researcher were recorded the sociodemographic data from the neonate's medical file (tool1). Body weight was measured at the same time each day (by digital baby scale Seca 728 at a 2 gram graduation) for all the neonates in both groups until the day of regaining birth weight; duration of hospitalization, parenteral nutrition and other health status were assessed serially. A neonate in each group was received the ordered amount of human milk or preterm infant formula according to trophic feeding protocol that applied in Egypt with parenteral nutrition.

Gastric Residual Volume (GRV) an important determinant of feeding tolerance was detected by aspiration of gastric contents from the indwelling nasogastric tube before every feeding; whenever the GVR was about 30% of the previous feeding volume, the residual was subtracted from the present amount then re-fed and the feeding schedule was resumed as planned. When GVR was more than 30%, without any ominous abdominal signs, two bolus feeds were held; if it was repeatedly more than 30%, feeds were held for 12 hours and neonates were followed for other signs of feeding intolerance like: color of aspirated content (bile or blood stained gastric residual), emesis, abdominal distention or tenderness, stool number, number of feeding stops and apnea which were noted in special checklists.

The observational check list signs of feeding intolerance (tool II) were checked by the researcher during the day and night after each feeding. The researcher attended NICUs units daily at morning shift and stay 8th hours / day at the NICUs, the researcher spend with each neonate one hour daily to file the two tools of the study. The study started from May 2013 to February 2014.

Validity and reliability

The tools were given to a panel of five experts in the field of high risk neonate and pediatric nursing to examine the content validity. No Modification was done. **Reliability** Conbach's alpha for reliability testing internal consistency was 0.80.

Pilot study

A pilot study was carried out on 10% of the total sample to test the feasibility of the study, applicability of tools and estimate the time required for filling the tools, the pilot study was not included in the sample.

Ethical consideration

Primary and final official permission to conduct the proposal study was obtained from the ethical committee of research of post graduate studies and research at faculty of nursing- Cairo University. Written informed consent was gained from parents of LBW neonates and after explaining the nature and purpose of the study to them. Confidentiality of the result was maintained; parents had a right to withdrawn from the study at any time without any effect on care providing for neonate.

Statistical analysis

The collected data was tabulated and summarized then was computerized and analyzed by used IBM SPSS advanced statistics version 20 (SPSS Inc., Chicago, IL), Qualitative data were expressed as frequency and percentage. Chi-square test was used to examine the relation between qualitative variables. For quantitative data, Mann-Whitney and Coefficient correlation tests were used to correlate two consecutive measures of numerical variables. The level of significance was accepted at P value ≤ 0.05.

6. Results

Neonates and their mother's characteristics: There was no statistical significant difference in the maternal age, educational level and occupation in neonates of both early and late trophic feeding groups.

Table (1) illustrates that no statistical significant difference between the early and late trophic feeding

groups regarding their gender, gestational age, birth weight and diagnosis.

Table (2) denoted that the mean weight in early group was increased significantly than late in the 1st week, 2nd and 3rd week (p = .42* , .000*** & .048* respectively) and the mean weight within the early group was increased significantly in the 1st week through 3rd week (F=.880 , p = .04*) while for the late group no significant differences was detected (f = .467. p = .371)

Table (3) indicated that the mean amount of parenteral nutrition per day in early trophic feeding group was decreased significantly than late in the 1st week ,2nd and 3rd week (p= .00, .02 & .01 respectively

Figure (1) illustrated that the mean length of hospital stay/ days in early group was decreased significantly than late group (10.9 ± 2.4, 14.5 ± 3.9 respectively), *p* = .05*.

Table (4) Signs of feeding intolerance show there were statistical significant differences in the two study groups at the 1st week (p = .001*, .001*, .044*, .000*, .002* respectively) except rigid abdomen, bile or blood stained residual, melina and passing stool more than 24 hours were not statistical significant differences (p = .360, .080, .500, 1.000, .307 respectively)

Table (5) Lethargy and hypothermia were documented more significantly in neonates of late group than early at the first week only (p = .033*, 000***) while the other signs of infection did not show statistical differences in the two study groups at the first, second and third weeks .

Table (6) showed that no correlation was detected between neonate's gestational age of both group and their weight gain at the first week, while the weight was correlated significantly for neonates of early group only who's gestational age more than 32 weeks at second week (p = .052*, .03* respectively) and third week (p =.05*,04*,04* respectively) . For neonates whose gestational age less than 32 weeks a significant weight gain was detected at third week only for early group (p = .05*). There were statistical significant correlation between weight gains of late group at gestational age 32-37 and ≥ 37 weeks (*p* = .05*, .05* respectively).

Table 1. Neonatal characteristics of both groups on admission (n = 100).

Neonatal characteristics on admission	Groups				Test	*P*
	Early		Late			
	No	%	No	%		
Gender						
Boys	27	54	23	46	χ^2 = .640	.424
Girls	23	46	27	54		
Gestational age / week						
28 - <32	8	16	7	14	t = 1.314	.275
32 -<37	25	50	11	22		
≥37	17	34	32	64		
Mean ± SD	34.4 ± 8.5		35.8 ± 9.7			
Birth weight /grams						
1500-	15	30	13	26	t = 1.346	.553
1701-	11	22	7	14		
1901-	9	18	9	18		
2101-	6	12	12	24		
2301-2499	9	18	9	18		
Mean ± SD	2114.3 ± 302.5		2241.3 ± 405.0			
Diagnosis:						
RDS	28	56	20	40	χ^2= 32.431	.137
Neonatal jaundice	4	8	13	26		
RDS+Pt	2	4	2	4		
Neonatal jaundice, RDS, Pt	16	32	15	30		
Total	50	100	50	100		

P*< .05

Note: RDS: Respiratory distress syndrome. – Pt: premature.

Table 2. Comparison of weight gain between and within both groups \ weeks.

Weeks	No.		Groups		t	*P*
			Early (E)	Late (L)		
	E	L	Mean ± SD	Mean ± SD		
1st week	50	50	2327.3 ± 579.0	1901.3 ± 302.5	3.899	.042*
2nd week	39	41	2006.4 ± 478.5	1730.9 ± 251.9	5.938	.000***
3rd week	10	24	2217.7 ±596.1	1736.4 ± 270.2	3.171	.048*
			F = .880 *P* = .04*	F = .467 *P* = .371		

P* < .05 P*** <.000

Table 3. Comparison of parenteral nutrition amount / ml / day between both groups / week.

Amount / ml / day	1st week				2nd week				3rd week			
	Early		Late		Early		Late		Early		Late	
	no.	%	no.	%	no.	%	no.	%	no.	%	no.	%
1-	22	44	5	10	27	69.2	0	0	8	80	4	16.7
101-	11	22	8	16	4	10.3	9	22	2	20	20	83.3
201-	12	24	16	32	5	12.8	17	41.5	0	0	0	0
301 - 400	5	10	21	42	3	7.7	15	36.5	0	0	0	0
Total	50	100	50	100	39	100	41	100	10	100	24	100
Mean ± SD	66.8 ± 8.1		100.2 ± 7.5		43.9 ± 6.8		85.1 ± 6.3		22.1 ± 3.5		70.9± 4.6	
t *P*	4.094 .00**				5.189 .02*				4.327 .01*			

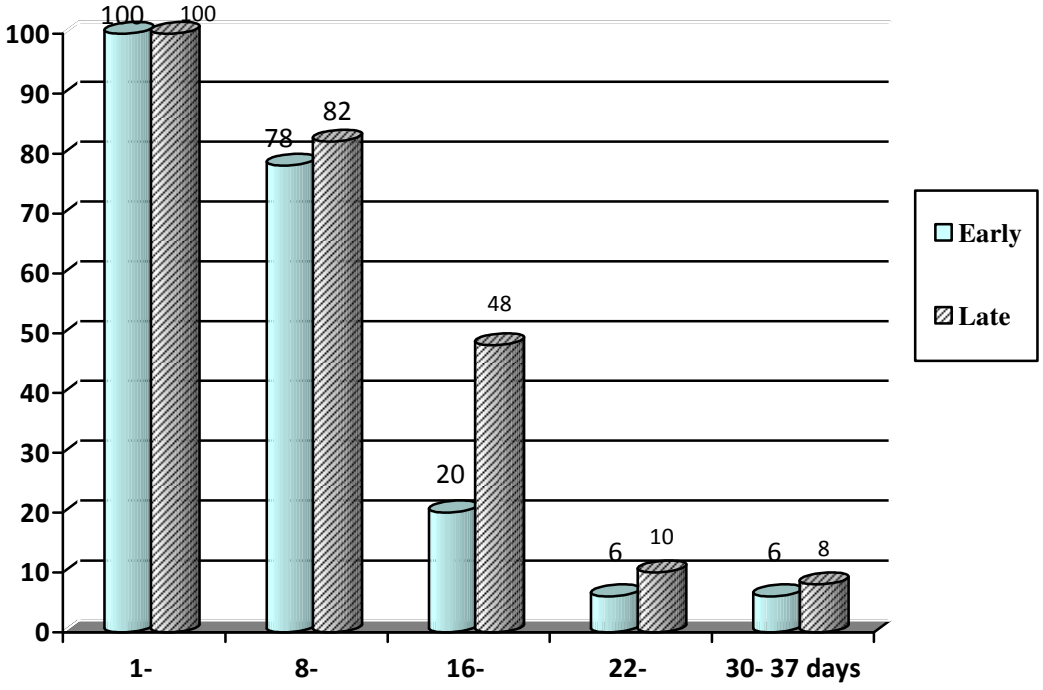

Fig 1. Comparison of hospital stay / day between both groups

Table 4. Feeding intolerance signs of both groups / weeks

Feeding intolerance signs	1st week				2nd week				3rd week			
	Early		Late		Early		Late		Early		Late	
	No	%	No	%	No	%	No	%	No	%	No	%
Rigid abdomen												
No	45	90	43	86	39	100	38	92.7	10	100	24	100
Yes	5	10	7	14	0	0	3	7.3	0	0	0	0
χ^2	0.379				2.965				----------			
P	.360				.130							
Bowel distension												
Yes	21	42	38	76	4	10.3	8	19.5	0	0	4	16.7
No	29	58	12	24	35	89.7	33	80.5	10	100	20	83.3
χ^2	11.947				1.343				1.968			
P	.001**				.200				.345			
Absence bowel sound												
No	30	60	3	6	38	97.4	38	92.7	10	100	20	83.3
Yes	20	40	47	94	1	2.6	3	7.3	0	0	4	16.7
χ^2	11.701				0.951				0.806			
P	.001**				.327				.369			
Diarrhea												
Yes	12	24	29	58	1	2.6	2	4.9	0	0	2	3.8
No	38	76	21	42	38	97.4	39	95.1	10	100	22	96.2
χ^2	3.664				0.297				0.545			
P	.044*				.519				.460			
Vomiting												
Yes	2	4	7	14	1	2.6	2	4.9	0	0	1	4.2
No	48	96	43	86	38	97.4	39	95.1	10	100	23	95.8
χ^2	3.053				0.297				0.137			
P	.080				.519				.865			
Abnormal abdominal girth												
No	45	90	21	42	33	84.6	24	58.5	10	100	14	58.3
Yes	5	10	29	58	6	15.4	17	41.5	0	0	10	41.7
χ^2	13.306				0.658				1.353			
P	.0001**				.307				.067			
Gastric residual volume 30%												
Yes	13	26	22	44	0	0	0	0	0	0	0	0
No	37	74	28	56	39	100	41	100	10	100	24	100
χ^2	9.301				----------				----------			
P	.002*											
Bile or blood stained residual												
Yes	1	2	2	4	0	0	0	0	0	0	0	0
No	49	98	48	96	39	100	41	100	10	100	24	100
χ^2	0.344				----------				----------			
P	.500											
Melina												
Yes	2	4	2	4	0	0	1	2	0	0	0	0
No	48	96	48	96	39	100	40	80	10	100	24	100
χ^2	0.720				0.963				0.526			
P	1.000				.512				.155			
No pass stool more than 24 hours												
Yes	1	2	3	6	0	0	0	0	0	0	0	0
No	49	98	47	94	39	100	41	100	10	100	24	100
χ^2	1.042				----------				----------			
P	.307											
Total	50	100	50	100	39	100	41	100	10	100	24	100

Table 5. Infection signs of both groups / week.

Infection signs	1st week				2nd week				3rd week			
	Early		Late		Early		Late		Early		Late	
	No	%	No	%	No	%	No	%	No	%	No	%
Apnea												
Yes	4	8	14	28	4	10.3	9	22	1	10	4	16.7
No	46	92	36	72	35	89.7	32	78	9	90	20	83.3
χ^2	0.735				2.009				0.545			
P	.260				.132				.655			
Lethargy												
Yes	15	30	28	56	5	12.8	9	22	1	10	10	41.7
No	35	70	22	44	34	87.2	32	78	9	90	14	58.3
χ^2	4.167				2.009				0.806			
P	.033*				.132				.330			
Hyperthermia												
Yes	7	14	13	26	2	4	4	9.8	0	0	0	0
No	43	86	37	74	37	74	37	90.2	10	100	24	100
χ^2	2.250				0.617				----------			
P	.105				.362							
Hypothermia												
Yes	9	18	28	56	3	7.7	4	10.3	0	0	0	0
No	41	82	22	44	36	92.3	35	89.7	10	100	24	100
χ^2	15.487				0.270				----------			
P	.000***				.476							
Hypoglycemia												
Yes	11	22	14	28	3	7.7	11	26.8	0	0	0	0
No	39	78	36	72	36	92.3	30	73.2	10	100	24	100
χ^2	0.480				1.161				----------			
P	.322				.289							
Cord inflammation												
Yes	-	-	0	0	0	0	0	0	0	0	0	0
No	50	100	50	100	39	100	41	100	10	100	24	100
χ^2	3.20				----------				----------			
P	.661											
Convulsion												
Yes	-	-	0	0	0	0	0	0	0	0	0	0
No	50	100	50	100	39	100	41	100	10	100	24	100
χ^2	2.04				----------				----------			
P	.25											
Total	50	100	50	100	39	100	41	100	10	100	24	100

P*<.05 P***<.000

Table 6. Relation between gestational age and weight gain

Item	Weight gain											
	1st week				2nd week				3rd week			
	Early		Late		Early		Late		Early		Late	
	r	*P*	r	*P*	r	*P*	r	*P*	r	*P*	r	*P*
Gestational age (weeks)												
28 - <32	.419	.656	.402	.324	.057	.051	.050	.907	.213	.05*	.210	.23
32 -<37	.197	.345	.132	.698	.620	.052*	.107	.768	.650	.04*	.314	.05*
≥37	.160	.569	.013	.949	.680	.03*	.336	.137	.695	.04*	.360	.05*

P*<.05

7. Discussion

Neonatal characteristics of both groups were similar in early and late trophic feeding with no significant differences regarding gender, gestational age, birth weight and medical diagnosis on admission. The finding

was agree with El- sayed, (2013) who studied the effect of early versus late start of minimal enteral nutrition on preterm infants and found that infants' characteristics were similar in the control and study group, with no statistical significant differences regarding gender, medical diagnosis, gestational age, and birth weight.

Recently enteral feeding has been encouraged in ill preterm neonates. Infants exposed to trophic feeding had significantly greater energy intake, greater weight gain and head growth, improved milk tolerance, less requirement for parenteral nutrition, less sepsis, fewer days of supplemental oxygen and were discharged from hospital earlier (McClure, Chatrath & Newell (1996) , Becerra, Ambiado & Kuntsman, (1996), Tyson &Kennedy, (2009) and McClure & Newell, (2012). Other findings are contributed to this knowledge; but for such an essential issue in the care of VLBW preterm infants, there is quite inadequate data about the start time of enteral feedings which has been compounded by its effect on important neonatal outcomes, particularly necrotizing enterocolitis (Berseth 1992, Archana & Shaikh, 2007, Tyson& Kennedy, 2009 and McClure & Newell,2012). The current study represented that LBW neonates that fed early their mean birth weight was significantly faster than those fed lately at the end of 1st and 2nd week . These results consistent with El-sayed, (2013) who reported that infants fed early regained their birth weight faster than those fed lately, with a statistical significant difference between the two groups. Also these current results consistent with Kliegman, Behrman and Stanton, 2011), Mishra, Agarwal, Deorari & Paul (2008) and Berseth & Nordyke (2008) who mentioned that low birth weight neonates who were fed earlier with minimal feeds had gained weight faster as compared to neonates who were fed late. In contrary Leaf et al, (2012) and Kennedy, Tyson & Chamnanvanikij (2009) reported that early trophic feeds had no significant effect on weight gain.

The current study represented that there was a statistical significant difference between both groups regarding amount of trophic feeding in the 1st, 2nd and 3rd week. This means that LBW neonates who starting feed earlier had fewer requirements of parenteral nutrition than late group. This finding goes in line with Kennedy, Tyson &Chamnanvanakij, (2009), and Sallakh-Niknezhad, Bashar-Hashemi, Satarzadeh, Ghojazadeh& Sahnaz-Arlig, 2012) who concluded that the LBW neonates who are exposed to early trophic feeding had fewer requirements for parenteral nutrition than those exposed to late trophic feeding.

Increased costs are relevant to prolonged inpatient stay (Petrou, Mehta & Hockley, 2003 and Flide, Friedman & Lev, 2004). Economic burden of NICU stay on family, government and insurance system is an important issue in preterm birth (Petrou, Mehta, Hockley, 2003 and Patole, 2005). Two systematic reviews on the matter revealed that trophic feeding resulted in significant reduction in stay days (Tyson & Kennedy 2009 and Kennedy, Tyson & Chamnanvanikij 2009). In the current study neonates in early group were associated with a decrease mean in length of hospital stay than late group; this reduction was significantly in early group which is a valuable finding. This results consistence with (Sallakh-Niknezhad, Bashar-Hashemi, Satarzadeh, Ghojazadeh& Sahnaz-Arligm, 2012) who reported that early trophic feeding was associated with a decrease in length of hospital stay; this reduction was by 42% in early group which is a valuable finding.

Results of the current study founded that the majority of early and late groups in the 1st week and 2nd week hadn't rigid abdomen and most of both groups in the 3rd week hadn't rigid abdomen. There were no statistical significant differences between the two groups about rigid abdomen in the 1st and 2nd week. This finding supported by Sallakh, (2012) who found that the signs of feeding intolerance such as rigid abdomen did not show statistical differences in the two study groups whereas infants in late feeding group delayed the time required attaining complete enteral feeding (160 ml / kg / day by tube-feeding).

Regarding bowel distension it was found that during the 1st week, two fifth of early group and three quarter of late group had bowel distension. In the 2nd week, the majority of early group and late group had no bowel distension but in the 3rd week majority of both groups hadn't bowel distension. There was statistical significant difference between the two groups about bowel distension in the 1st week only, although infants in both groups had some minor bowel distension in the second and third week but it was not significant. This finding supported by Henderson, Anthony & McGuire(2007),who reported that early enteral feeding was associated with better endocrine adaptation, enhanced immune functions and gut motility. Also Mishra, Agarwal, DeorarI & Paul, 2008) and Schanler, 2011) reported that a prolonged delay in starting feeds in preterm neonates may be partly responsible for the common problem of feeding intolerance in these tiny newborns. These problems may then hinder the transition from parenteral to enteral nutrition and thus prolonged hospital stay.

From the researcher point of view the absent of bowel distension clarify there was tolerance signs occurred and also early trophic feeding aiding maturation of gut motility, induction of gut hormones, and prevention of adverse effects of enteral fasting and parenteral nutrition on the mucosa, also provide luminal nutrient stimulation to the immature or vulnerable neonatal gastrointestinal tract to prevent the adverse effects of prolonged enteral fasting. The finding contracted with Tyson & Kennedy, 2009) who examined the role of trophic feeding on milk tolerance; and found that although infants in both groups had some minor gastrointestinal complications but it was not significant.

The current study showed that during the 1st week, minority of early group and more than half of late group had abnormal abdominal girth. There was highly statistical significant difference between the two groups

about abnormal abdominal girth in the 1st week. The significant present of abnormal abdominal girth in both group means that there was sign of feeding intolerance but the high frequency of abnormal abdominal girth appear in late group (58%) than early group (10%) because the LBW neonate in late group also had bowel distension, that means if the bowel full by gasses can increase the abdominal girth than normal range (> 2 centimeter) (El- sayed, 2013).

Concerning absence of bowel sound in the 1st week, there were statistical significant differences between the two groups about absence of bowel sound, tow fifth of early group and most of late group had absence bowel sound. While in the 2nd and 3rd week most of early and late groups had normal bowel sound. This finding supported by Mishra, Agarwal, DeorarI & Paul, 2008) who reported that a prolonged delay in starting feeds in preterm neonates may be partly responsible for the common problem of feeding intolerance such as absence of bowel sound in these tiny newborns. Starvation or the prolonged absence of enteral nutrition disrupts the barrier functions of the gastrointestinal tract resulting in gut atrophy. Schanler, (2011), stated that lack of enteral nutrients may diminish gastro-intestinal functional and structural integrity by diminishing hormonal activity, growth of intestinal mucosa, and nutrient absorption. From the researcher point of view when the gastro-intestinal functional and structural integrity were diminished that can lead to decreased bowel motility and sound.

Regarding incidence of diarrhea, there was significantly higher frequency in the late group than early group in the 1st week, while in the 2nd and 3rd week although neonates in both groups had minimal diarrhea but it was not significant. In addition the majority of early and late groups had no vomiting in the 1st week, 2nd and 3rd. The finding clarified by Amin, Azad Chowdhury, Monir Hossian, & Mahbubul Hoque, 2007) who stated that late enteral feeding could diminish the functional adaptation of the gastrointestinal tract and results in feeding intolerance later followed by NEC. Additionally there was more studies that are recent have demonstrated the positive direct and indirect trophic effects of MEN on preterm infants, even when administered for brief periods. Direct contact of the gut tissue with milk increases intestinal mass and enhances the synthesis rates of gut hormones. In addition, most of its substances have complex and vital roles in other aspects of gastrointestinal tract function, such as nutrient absorption and digestion (Grover, Khashu, Mukherjee & Kair, 2008). Our result goes with this finding so that any disturbance in nutrient absorption and digestion can lead to diarrhea and vomiting.

There was a statistical significant difference between the two groups about gastric residual volume in the 1st week. This result was supported by Cobb, Carlo & Ambalavanan, 2004) who's reported that smaller gastric residuals aspirated from the previous feed during the period of providing MEN are indicative of reduced risk of NEC. El- sayed, (2013) found that number of gastric residue aspirate through MEN period (> 25%), number of infants with significant episode(s) of abdominal girth increment through MEN period that leading to feeding cessation (>2cm), and enteral feeding withheld (hours) were collected.

For melina in the 1st, 2nd and 3rd week, the majority of both groups hadn't melina. In the 1st, 2nd and 3rd week most of both groups pass stool during the first 24 hours. Melina as signs of feeding intolerance was detected in the 1st and 2nd week in late group than early group but it was not significant, however blood in stools or melina as sign of feeding intolerance can be manage by discontinue feedings; consider obtaining clotting studies and abdominal radiograph, if there is any doubt about how well an infant is tolerating feedings, it is best to hold feedings, evaluate the infant and discuss the case with a senior staff member (Anderson, 2009).

The current study delineates the apnea that did not occurred in the 1st, 2nd and 3rd week among the majority of early and more than three quarter of late groups. The finding supported by Wilson, Cairns, Halliday, Reid, McClure & Dodge (2007) who studied 12 trials and who reported that frequency of complications of feeding such as apnea was more in late feeding than early feeding group having no significant difference in this regard. While contradicted by Dhingra, Agrawal, Kumar & Narang (2009) who reported that the incidence of apnea did not significantly differ between both groups.

It was clear that lethargy did not found in the 1st week among more than two third of early group and less than half of late. There were statistical significant differences between the two groups about lethargy in the 1st week. There was statistical significant difference between the two groups about hypothermia in the 1st week. From the researcher point of view the lethargy and hypothermia as signs of infection were detected highly frequency in late group than early group but the LBW neonates were not received any antibiotic drugs and diagnosed as cases had infection.

Considering the hypoglycemia in the 1st week majority of both groups hadn't hypoglycemia; 2nd week minority of early group had hypoglycemia and more than one fifth of late group had hypoglycemia; 3rd week most of early group and late group hadn't hypoglycemia. There were no statistical significant differences between two the groups about hypoglycemia in the 1st and 2nd week. The finding goes with line of many authors: (Ekblad, Kero & Takala 2008) who found that infants who received earlier nutrition support showed trends toward a lower incidence of elevated serum blood glucose so that this point means the infant had elevated serum blood glucose and started trophic feeding early, whose serum blood glucose become normal, also, Dhingra,

Agrawal, Kumar & Narang,(2009) who found that the incidence of hypoglycemia did not significantly differ between early and late trophic feeding. Another interesting study goes with the current finding (Wang, Dorer & Flemingm 2004) who found that early initiation of enteral feedings is a successful strategy to maintain stable glucose balance in premature infants.

Umbilical cord care is one of the most important and challenging aspects of neonatal care. Nursing care is a critical element in the neonate's chance for survival. LBW infants with neonatal tetanus often have a concomitant cord infection, which points to a common cause (i.e. unclean delivery and cord care practices). It was found that cord did not inflame in the1st, 2nd and 3rd week among most of early and late group. There was no statistical significant difference between the two groups concerning cord inflammation in the 1st week. Also convulsion not occurred among the most of early and late group in the 1st, 2nd and 3rd week. There was no statistical significant difference between the two groups about convulsion in the 1st, 2nd and 3rd week.

The current study showed that no correlation was detected between neonate's gestational age of both group and their weight gain in the 1st week, while in the 2nd week the weight gain was correlated significantly for neonates of early group only who's gestational age 32 – 37 week and > 37 weeks and also in the 3rd week For neonates whose gestational age 28 weeks a significant weight gain was detected in the 3rd week only for early group .There were statistical significant correlation between weight gains of late group at gestational age 32-37 and ≥ 37 weeks. From the researcher point of view this result is logical as the gestational age near the term the LBW neonates regain weight soon and that appear in early group than late group and also the length of hospital stay was shorter in early group than late group due to early feeding.

8. Conclusion

Based on the findings of the study can conclude that starting the early trophic feeding is effective for LBW neonates than late trophic feeding group in increasing weight gain, amount of trophic feeding, decreasing amount of parenteral nutrition, decrease signs of milk intolerance, infection, and length of hospital stay.

9. Recommendations

Based on the main findings of the present study, the following recommendations are suggested that all NICUs must apply early trophic feeding for LBW neonates to decrease hospital coast. Replication of the study on large sample size and in different setting.

10. Conflict of Interest

None

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References

Amin T, Azad Chowdhury MAK, Monir Hossian M and Mahbubul Hoque M (2007), Growth Pattern of Early and Late Breast Fed Preterm (30-35Weeks' Gestation) Neonates: A Hospital Based Study, Dhaka Shishu Hospital, Dhaka, Bangladesh.

Anderson-Berry AL, (2009), Neonatal sepsis. Available at: http://www.emedicine.com.
Accessed on: June.

Archana B, Shaikh PS. (2007), Efficacy of breast milk gastric lavage in preterm neonates. Indian Pediatric; 44(3):199–203.

Becerra M, Ambiado S, and Kuntsman G, (1996), Feeding VLBW infants; Effect of early enteral stimulation (EES). Pediatr Res; 39:304A.

Berseth CL (1992), Effect of early feeding on maturation of the preterm infant's small intestine. J Pediatr 120:947–953.

Berseth CL and Nordyke C (2008), Enteral nutrients promote postnatal maturation of intestinal motor activity in preterm infants. Am J Physiol.; 264(6 pt 1):G1046–51.

Bisquera JA, Cooper TR and Berseth CL (2007), Impact of necrotizing enterocolitis on length of stay and hospital charges in very low birth weight infants. Pediatrics: 109(3):423–8.

Bombell S and McGuire W (2009), Early trophic feeding for very low birth weight infants. Cochrane Database of Syst Rev.; 3:CD000504. [PubMed]

Centers for Disease Control and Prevention, (2011-2012).
Cobb B.A., Carlo W.A. and Ambalavanan N (2004), Gastric residuals and their relationship to necrotizing enterocolitis in very low birth weight infants. Pediatrics, 113: 50-53, 2004.
Davey AM, Wagner CL and Cox C (1994), Feeding premature infants while low umbilical artery catheters are in place: a prospective, randomized trial. J Pediatr; 124 (5 pt 1):795–9. [PubMed]
Donovan, Puppala, Angst and Coyle, (2006), Clinical outcomes of near-term infants. Pediatrics, 114: 372-376.
Dhingra, A, Agrawal, S.K.; Kumar, P. and Narang, A (2009), A randomised controlled trial of two feeding schedules in neonates weighing ≤1750 g. J. Matern. Fetal Neonatal Med. 22, 198–203.
Ekblad H., Kero P. and Takala J (2008), Stable glucose balance in premature infants with fluid restriction and early enteral feeding, Acta. Paediatrica, 76 (3): 438-43.
EL-sayed, R.N (2013), the effect of early versus late start of minimal enteral nutrition on clinical outcomes of parenterally fed preterm/very low birth weight infants, Med. J. Cairo Univ, volume 81, No. 1.Grover M., Khashu A., Mukherjee V. and Kair-Amkonda V (2008), Iatrogenic Malnutrition in Neonatal Intensive Care Units: Urgent need to modify practice. Journal of Parenteral Enteral Nutrition, 32 (2): 140-144.
Flidel-Rimon O, Friedman S, and Lev E, (2004), Early enteral feeding and nosocomial sepsis in very low birth weight infants. Arch Dis Child Fetal Neonatal Ed;89 (4):289-92.
Grover, A., Khashu, M., Mukherjee, A., & Kairamkonda, V. (2008), Iatrogenic malnutrition in neonatal intensive care units: urgent need to modify practice. Journal of parenteral and enteral nutrition, 32 (2), 140-144.
Henderson G, Anthony M.Y & McGuire W (2007), Formula milk versus maternal breast milk for feeding preterm or low birth weight infants. Cochrane Database
Khayata S, Gutcher G, and Bamberger J, (1987), Early versus late feeding of low birth weight (LBW) infants: Effect on growth and hyperbilirubinemia. Pediatr Res.; 21:431A.
Kennedy KA, Tyson JE and Chamnanvanikij S (2009), Early versus delayed initiation of Progressive enteral feedings for parenterally fed low birth weight or Preterm infants. Cochrane database of Syst; 300:1050-23.
Kliegman RM, Behrman RE, and Stanton BF (2011), Nelson Text Book of Pediatrics. 19th ed. Philadelphia: Saunders;. pp. 978–80.
LaGamma EF, and Browne LE (1994), Feeding practices for infants weighing less than 1500 G at birth and the pathogenesis of necrotizing enterocolitis. Clin Perinatol.; 21(2):271–307. [PubMed]
Leaf, A.; Dorling, J.; Kempley, S.; McCormick, K.; Mannix, P.; Linsell, L.; Juszczak, E (2012), Brocklehurst, P. Early or delayed enteral feeding for preterm growth-restricted infants: A randomized trial. Pediatrics, 129, e1260 – e1268.
Levine GM, Deren JJ, Steiger E, & Zinno R. (1974), Role of oral intake in maintenance of gut mass and disaccharide activity. Gastroenterology. Nov;67(5):975–982. [PubMed]
McClure RJ, Chatrath MR, Newell SJ (1996), A survey of the variety and changing trends in feeding policies for ventilated pre-term infants in the United Kingdom. Acta Paediatr85:1123–1125.
McClure RJ & Newell SJ, (2012), Randomized controlled study of clinical outcome following trophic feeding. Arch Dis child fetal neonatal End; 82(1): F29-33.
Mishra S., Agarwal R., Ashok-deorari M.J & Paul V.K (2008), Minimal Enteral Nutrition. WHO Col-laborating Centre for Training & Research in Newborn Care, Division of Neonatology, Department of Pediatrics, Ansari Nagar, New Delhi-110029, AIIMS-NICU protocols.
Patole, S (2005), Strategies for prevention of feed intolerance in preterm neonates: A systematic review. J Maternal-Fetal Neonatal Med;18(1): 67-76.
Petrou S, Mehta Z & Hockley C, (2003), The impact of preterm birth on hospital inpatient admissions and costs during the first 5 years of life. Pediatrics;112(6 pt 1):1290–7.
Sallakh-Niknezhad A., Bashar-Hashemi F., Satarzadeh N., Ghojazadeh M. & Sahnaz-Arlig (2012), Early versus Late Trophic Feeding in Very Low Birth Weight Preterm Infants. Iran. J. Pediatr., 22 (2): 171-176.
Schanler RJ, Shulman RJ & Lau C, (2011), Feeding strategies for premature infants: randomized trial of gastrointestinal priming and tube-feeding method. Pediatrics. 103(2):434–9.
Schanler RJ (2011), Enteral Nutrition for the High-Risk Neonate. In Avery's Disease of the Newborn, 8th .Ed. Taeusch HW, Ballard RA, Gleason CA (eds), Philadelphia, Elsevier Saunders; (68): 1056.
Thureen JP (1999), Early aggressive nutrition in the neonate, Pediatr Rev 45–55.20(9):
Tyson JE & Kennedy KA (2009), Trophic feedings for parenterally fed infants, Cochrane Database of Syst Rev.; 3:CD000504. [PubMed]
Wang M.L., Dorer D.J & Fleming M.P (2004), Clinical outcomes of near-term infants. Pediatrics, 114: 372-376.
Williams AF (1997), Role of feeding in the pathogenesis of necrotizing enterocolitis. Semin Neonatal.; 2(4):263–71
Wilson DC, Cairns P, Halliday HL, Reid M, McClure G & Dodge JA (2007), Randomised controlled trial of an aggressive nutritional regimen in sick very low birth weight infants. Arch Dis Child; 77: 4-11.

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