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EFFECT OF DHA SUPPLEMENTATION IN PRETERM NEONATES ON WEIGHT GAIN AND DURATION OF HOSPITAL STAY

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ABSTRACT Long-chain polyunsaturated fatty acids (LC-PUFA) including docosahexaenoic acid (DHA) and arachidonic acid (ARA) are essential for normalgrowth, vision, neurodevelopment and overall health. In addition, DHA levels in very low birth weight(VLBW) infants remains low due to inadequate fat stores, ineffective conversion from precursor fatty acids and a limited postnatal nutritional supply. DHA and ARA (22- and 20-carbon LCPUFAs, respectively) may be obtained directly through the diet—oily fish for DHA, meat and eggs for ARA—or from their 18-carbon precursor FAs, α-linolenicacid (ALA) and linoleic acid.[1,2] Present study has tried to evaluate the effect of DHA on weight improvement of the low birth weight infants and length of hospital stay. By the end of 4th week, the mean weight gain was slightly better among cases than controls and mean duration of hospital stay was low among cases than controls.

SUMMARY :- Long-chain polyunsaturated fatty acids (LC-PUFAs), especially DHA is very crucial for brain development during early life. DHA supplementation is also associated with early recovery of critical neonates, as mean length of ICU and hospital stay was found to be shorter in DHA supplemented. DHA supplementation was associated with better weight gain at the end of 4 weeks.

KEYWORDS : LC-PUFA,DHA,VERY LOW BIRTH WEIGHT NEONATES

INTRODUCTION

Essential LCPUFAs are important components of the phospholipid bilayer of cell membranes, contributing to structural integrity and function throughout the body.

In vitro and animal studies demonstrate their many functions. In the brain and retina, they have highly specialized functional roles making them important for normal signal transduction, neurotransmission and neurogenesis. In tissues throughout the body, they are released from membranes by phospholipases for conversion to important hormones, eicosanoids, lipoxins and resolvins that mediate inflammation, immune function, platelet aggregation and lipid homeostasis. They also serve as local signalling molecules and transcription regulators of genes involved in inflammation, development and metabolism. Their ubiquitous arrangement and multifaceted functionality make LCPUFAs extremely important for normal growth, development and overall health. DHA (docosahexaenoic acid) is a fatty acid found in the meat of cold-water fish, including mackerel, herring, tuna, halibut, salmon, cod liver, whale blubber, and seal blubber.

DHA is used as a supplement for premature babies and as an ingredient in baby formula during the first four months of life to promote better mental development. This practice probably started because DHA is found naturally in breast milk. DHA is also used in combination with arachidonic acid during the first four to six months of life for this purpose.

Humans can synthesize saturated and monounsaturated FAs but lack the enzymes required to synthesize omega-3 and omega-6 LCPUFAs de novo. Thus, they are essential and must be taken in through diet. DHA and ARA (22- and 20-carbon LCPUFAs, respectively) may be obtained directly through the diet—oily fish for DHA, meat and eggs for ARA—or from their 18-carbon precursor FAs, α-linolenic acid (ALA) and linoleic acid

DHA & PREMATURITY

Because DHA cannot be synthesized de novo, the developing fetus is dependent on a maternal source. Most DHA accumulation occurs during the third trimester of pregnancy when growth and brain development are rapid. Hormonal changes during pregnancy induce a hyperlipidemic state, increasing the availability of all circulating lipids; estrogen further increases conversion of precursor ALA to DHA, sustaining preferential uptake.[5,22,23,24]FA transport across the placenta is both passive and active. Passive transport is directly dependent on maternal blood levels, whereas active transport occurs through FA transport proteins, which are upregulated during pregnancy to preferentially transport LCPUFAs to the fetal blood stream.

Infants born before this process is complete have interruption in normal LCPUFA accretion. Indeed, preterm infants have lower DHA levels than their term peers. Furthermore, in very preterm infants (<28 weeks gestation), this deficit persists or worsens due to decreased adipose stores, a limited ability to convert precursor ALA to DHA and poor nutritional provision of preformed LCPUFA.[7,12,13,18]

Relying on dietary intake to overcome this deficit is not plausible because this population often does not reach full enteral feedings until after several weeks of age, forcing them to rely heavily on parenteral nutrition early in life.[6] Commercially available intravenous lipid emulsions provide essential precursor FAs only, rather than preformed DHA. This formulation may be sufficient to avoid essential FA deficiency in adults, but is inadequate to maintain DHA levels in VLBW infants due to decreased desaturase conversion and increased demands during rapid growth and neurodevelopment.[24,25]These factors are unique to premature infants and contribute to persistently low DHA levels, especially if complications of prematurity or illness further delay the advancement of feedings.

Even after full enteral feedings are reached, nutritional options available in the neonatal intensive care unit provide extremely variable daily allowances of DHA that do not account for the relative deficits of premature infants. Mother's own milk is the recommended diet for all infants and provides both ARA and DHA.[13,14,15]However, there is a wide variation in DHA content (from 0.06 to 1.4wt; wt%) based on regional,

individual dietary and lactation differences. Milk from lactating mothers who deliver prematurely is higher in DHA than those who deliver at term.

Despite supplementation, neither breast milk nor formula, which offers a calculated range of 3 to 23 mg per day after full feedings are reached, can match the estimated uterine accretion rate of 42 to 75 mg per day of DHA. In addition, only 80% of DHA given enterally is absorbed in the intestine, and feeding practices in the neonatal intensive care unit may further decrease DHA provision. Continuous drip feedings through a gavage tube markedly decrease fat provision, presumably as lipids adhere to the plastic tubing. Given these factors, enteral doses may need to be closer to 65 mg per day, which approximates 1 to 1.5 wt : wt% of FAs in human milk or formula to meet the needs of premature infants. For these reasons, a critical reevaluation of the proper dose and method of delivery to overcome the 'DHA gap of prematurity' is critical to support the normal health and development of this at-risk population.

METHODS

Newborns delivered at Geetanjali Medical College and Hospital with gestation age 24 completed weeks to 34 completed weeks that fulfilled the inclusion and exclusion criteria were eligible for enrolment, after taking written informed consent of their parents or guardians.

Inclusion Criteria

Preterm neonates delivered by vaginal or cesarean between 26 to 34 weeks of gestational age and weight less than 1800 grams.

Exclusion Criteria:

Preterm neonates with major congenital malformations.

Randomization scheme was used to assign the neonates (60 pts) to treatment groups in a 1:1 ratio and half (30 pts) of the infants were supplemented with 20 mg DHA daily for 28 days from start of feeding. During the stay in NICU, daily weight of the newborns was access and after discharge the duration of hospital stay was compared between the two groups.

Nursing staff of NICU and neonatologist were kept blinded about the study. Investigations were sent as per the protocol.

Assessment Parameters were weight gain and length of hospital stay.

RESULTS

Table 1. Group Distribution

Group	N	%
Cases	30	50.0%
Controls	30	50.0%
Total	60	100.0%

Study included preterm neonates between 26 to34 weeks of gestational age and weight less than 1800 grams. A computer-generated randomization scheme was then used to assign the 60 study infants to treatment groups in a 1:1 ratio with cases receiving 20 mg DHA daily for 28 days from start of feeding through NG or orally and controls undergoing routine management as per protocol.

Table 2. Comparison of mean weight between two groups.

Variables	Group	N	Mean	SD	p- value
Weight at birth (Kg)	Cases	30	1.42	0.28	0.139
	Controls	30	1.30	0.32	
Weight on 28th day (Kg)	Cases	30	1.68	0.36	0.096
	Controls	30	1.51	0.41	
Weight gain (Kg)	Cases	30	0.26	0.11	0.092
	Controls	30	0.21	0.12	

Mean weight at birth was comparable between cases and controls (1.42 vs 1.30; p-0.139). By the end of 4th week mean weight gain was slightly better among cases (0.26 Kg vs 0.21 Kg), the difference was however statistically insignificant (p-0.092).

Table 3. Comparison of length of hospital stay and length of ICU stay

Variables	Group	N	Mean	SD	p- value
Length of hospital stay	Cases	30	25.80	20.27	0.127
	Controls	30	34.80	24.53	
Length of ICU stay	Cases	30	21.33	18.91	0.101
	Controls	30	30.50	23.41	

Mean length of hospital and ICU stay was slightly lower among cases as compared to controls (25.8 vs 34.8 days & 21.33 vs 30.5 days).The difference was however statistically non-significant (p>0.05).

CONCLUSION

DHA plays an important role in the neurodevelopment and overall health of preterm neonates. The preterms who are born before complete transfer of DHA from mother to the fetus is complete, should be supplemented with DHA. DHA supplementation is associated with reduced duration of hospital stay and is associated with better growth during NICU stay.

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