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Relationship between docohexaenoid acid in breastmilk and development scores at infant 18–23 months of age☆

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Abstract
Objective: This study was conducted to evaluate the relationship between DHA and development of motoric, cognitive, and socioemotional (DMCS) at infant 18–23 months of age.
Methods: This was a cohort study following a supplementation to pregnant and lactating mothers with *Moringa oleifera* leaf (MOL) or iron folic acid (IFA). DHA in breastmilk was measured at 6 months of age ($n = 64$). DMCS was measured at their age 18–23 months using CREDI (Caregiver Reported Early Childhood Development Index). All measurements were assessed by trained field workers using a standard questionnaire and data was analyzed using *Spearman Correlation*.
Results: Majority of mothers were between 20 and 35yr old (71.9%), less than 12yr of education (71.9%), household wife (84.4%), and from farmers family (40.6%). There were borderline significant relationships between DHA levels and cognitive and motoric score ($p = 0.096$, $r = 0.210$ and $p = 0.064$, $r = 0.233$ respectively for cognitive and motoric). However, there was a significant relationship between DHA and socioemotional score ($p = 0.049$, $r = 0.247$).
Conclusion: We conclude that DHA in breastmilk 6 months would predict the development of motoric, cognitive, and socioemotional of infant at the period of 18–23 months of age.

Introduction

The health and nutritional status of the mother during the pre-pregnancy period, during her pregnancy and while breastfeeding is a very critical period, as is the first thousand days of life from the moment of conception to the age of 2 years. If this period is not properly utilized, permanent

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damage will occur. The impact is not only on physical growth, but also on mental development and intelligence, in adulthood, physical size is not optimal and the quality of work is not competitive which results in low economic productivity.[1]

It is estimated that 200 million children under 5 years old in the world do not reach their development potential and most of them live in low and middle income countries.[2] In 2010, an estimated 33% of children aged 3 and 4 in low and middle income countries, 80.8 million children failed to meet basic standards in cognitive and or socio-emotional development.[3]

The effort to realize a healthy, strong and intelligent baby is by providing nutritious food. Mother's milk is considered an ideal food for new born who are healthy and meet nutritional requirements for their growth for the first 6 months of life.[4] Intake of polyunsaturated fatty acids (PUFA) in pregnancy and early life mainly DHA and AA is very important in the development of nerve cells, retina, and brain, both of which are available for infants through breast milk.[5,6]

Many studies have examined the hypothesis of early DHA intake affecting the rate of accumulation of DHA in the brain during the acceleration of early brain growth and hence have been shown to affect cognitive development in children, but the findings are inconsistent. Several trials have been carried out with fish oil supplementation in mothers during pregnancy and lactation, as well as trials with the addition of DHA in infant formulas have shown beneficial effects on cognitive development.[7] But in another study giving lipid-based nutritional supplements (LNS) to mothers during pregnancy and 6 months postpartum and their children from the age of 6–18 months did not increase physical activity in children aged 18 months.[8]

In this study we sampled mothers who had been given Moringa leaf supplements during the second trimester of pregnancy and the first week postpartum to assess the association of sixth month breast milk DHA with motoric, cognitive and socioemotional development in infants aged 18–24 months.

Method

Design

This study was a cohort study after supplementation of pregnant and lactating women with Moringa leaves (MOL) or iron folic acid (IFA).

Population and study setting

The subjects of this study consisted of mothers and their children who were previously registered in an experimental study giving prenatal Moringa leaf supplements to assess the effects of Moringa leaf (moringa oleifera) for prevention of anemia in LBW pregnant women in 6 districts in Jeneponto Regency from July 2016 to July 2017. In brief, 453 second trimester pregnant women who were eligible were given intervention in 3 groups in the form of Moringa extract, Moringa flour and iron folate by randomized double blind control. Each intervention ingredient weighing 500 mg, consumed for 90 days and subsequently carried out

Table 1 Frequency distribution of study subject characteristics.

Variable	Frequency ($n = 64$)	Percentage (%)
Mother age		
20–35 years old	46	71.9
<20 and >35 years old	18	28.1
Mother job		
Working	10	15.6
Not working	54	84.4
Mother education level		
≥12 years	18	28.1
<12 years	46	71.9
Mother BMI		
<18.5	9	14.1
18.5–22.9	24	37.5
>22.9	31	48.4
Anemia at 3rd trimester		
Not anemic	36	56.3
Anemic	28	43.8
Maternal prenatal supplementation regiment		
Moringa flour	22	34.4
Iron	21	32.8
Moringa extract	21	32.8
Gestational age		
Aterm (≥37 weeks)	61	93.5
Preterm (<37 weeks)	3	4.7
Sex		
Male	36	56.3
Female	28	43.8
Birth length		
≥48 cm	52	81.3
<48 cm	12	18.8
Birth weight		
≥2500 g	62	96.9
<2500 g	2	3.1
Breastfeeding type		
Exclusive	32	50
Non-Exclusive	32	50
Complementary feed to Breastfeeding		
≥6 months	46	71.9
<6 months	18	28.1
WHZ		
Normal + fat	56	87.5
Very thin + thin	8	12.5
HAZ		
Normal	31	48.4
Stunting	33	51.6
WAZ		
Normal nutrition	46	71.9
Inadequate + poor nutrition	18	28.1

post-intervention Hb measurements and measurements of birth weight after birth.

The eligible mothers in this study were mothers after childbirth and their babies who were 1 month old at the time of recruitment between May and July 2017. The initial population was 90 eligible mothers and registered for Breastfeeding DHA examination in the 6th month postpartum. At the time of examination of the development of the baby at the age of 18–23 months, as many as 64 participants were eligible, constrained they moved residence.

Variables and data collection

The variables of this study were DHA levels in breast milk, and motor, cognitive and socio-emotional development scores of infants aged 18–23 months. Sampling for breast milk was performed at the 6th month postpartum, at 8–12 am using a pigeon brand breast pump. Furthermore, breast milk was stored in 7 ml sterile tubes and stored at −80 °C and analyzed by the Laboratory of the Hasanuddin University Hospital, Makassar. DHA levels in breast milk were measured using the ELISA method with the Thermo USA Elisa Reader tool. Anthropometric measurements (WHZ, HAZ, and WAZ) were calculated using the WHO 2005 child growth standards. Infant motor, cognitive and socioemotional (DMCS) development was measured at their ages between 18 and 23 months ($n = 64$) using the CREDI instrument (Caregiver Reported) Early Childhood Development Index). CREDI is a simple, low-cost tool reported by caregivers or child care providers, for household surveys that have been tested for validation and reliability which have also been used in Tanzania. All measurements were assessed by trained field workers using a standard questionnaire. Data were analyzed using the Spearman Correlation Test and Mann Whitney with a significance level of 95%.

Ethical aspect

Ethical clearance was issued by the Health Research Ethics Committee of the Hasanuddin University School of Public Health, and subjects were asked to sign an agreement before being included in the study.

Results

Characteristic data shows that most mothers aged 20–35 years old, housewives, less than 12 years of education, normal third trimester Hb, preterm parturition, and get Moringa flour supplements. Most children were male, had a birth weight of cm48 cm, birth weight of ≥2500 g, were given exclusive breastfeeding, normal WHZ, normal WAZ and stunting (Table 1).

In Table 2, there is a significant relationship between DHA breast milk and social-emotional score ($p = 0.049$, $r = 0.247$), and the relationship in the acceptance limit between DHA levels and cognitive and motoric scores ($p = 0.064$; $r = 0.210$ and $p = 0.064$; $r = 0.233$).

Table 3 shows that there was no significant differences ($p > 0.05$) for motoric and cognitive scores in the exclusive and non-exclusive breastfeeding groups (each $p = 0.450$; $p = 0.928$). However, in the socioemotional score there was significant difference in the limits of acceptance of exclusive and non-exclusive breastfeeding groups ($p = 0.073$).

Discussion

This study proves that DHA in breast milk has a relationship with development in infants aged 18–23 months. The main finding is that DHA in high ASI shows a significantly higher socioemotional development score, but the scores on motor and cognitive development have a relationship that is still within acceptable limits. When viewed from breastfeeding there is no significant difference between exclusive breastfeeding and non-exclusive breastfeeding on motoric and cognitive development scores, but on socioemotional development scores have significant differences in acceptance limits. This is due to the measurement of DHA ASI carried out only once in the 6th month, and the composition of ASI fatty acids tends to change during breastfeeding. This fact explains why no strong correlation was found between DHA and developmental scores. However, this study proves

Table 2 Relationship between DHA and motoric, cognitive socio-emotional development.

Variable	Cognitive score		Motoric score		Socioemotional score	
	P value	*R*	*P* value	*r*	*P* value	*r*
Breastmilk DHA (N = 64)	0.096	0.210	0.064	0.233	0.049*	0.247

* Spearman correlation test.

Table 3 Relationship between exclusive breastfeeding and motoric, cognitive, and socioemotional development.

Variable	Motoric score		Cognitive score		Socioemotional score	
	Mean ± SD	*P* value	Mean ± SD	*P* value	Mean ± SD	*P* value
Exclusive bm ($n = 32$)	4.15 ± 0.98	0.450	14.78 ± 4.24	0.928	17.09 ± 3.73	0.073
Non-exclusive ($n = 32$)	4.28 ± 0.99		15.06 ± 3.75		14.62 ± 5.14	

* Mann–Whitney test.

our hypothesis that DHA in breast milk can predict motor, cognitive and socioemotional development in infants 18–23 months.

A study in Nunavik, the northernmost part of Quebec Province, the Inuit coastal region found higher umbilical cord DHA concentrations were associated with more optimal visual, cognitive, and motor development in infants 6 and 11 months.[9] Whereas in a study conducted at the University of North Carolina Hospitals prenatal clinic which suggested that neither breastfeeding exclusivity nor DHA and AA concentrations in breast milk and formula milk were related to visual acceptance, language skills, motor development, and cognitive in 12-month-old infants.[5]

Increased levels of DHA in breast milk cause an increase in storable doses in infant plasma and DHA erythrocyte phospholipid, but it is known that the composition of ASI fatty acids changes during breastfeeding. Therefore, factors that can influence breastfeeding, such as differences in the level of mother's knowledge, family influence, and values/beliefs, require the provision of clear information and an understanding of the culture of exclusive breastfeeding.[10–12]

Conclusions

We conclude that DHA in 6-month breast milk predicts infant motor and cognitive development in the period of 18 to 23 months. This study supports the recommendation of giving exclusive breastfeeding in the first 6 months and continued breastfeeding until the baby is 2 years old. Future studies should be considered other factors that influence development scores in age infant 18–23 month.

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Conflict of interest

The authors declare no conflict of interest.

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