

A Randomised Controlled Trial of
DHA-Rich Fish Oil
Supplementation During
Pregnancy and Subsequent
Development of Language in
Early Childhood

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ABSTRACT

There is no more important period in human development than conception through early childhood in maximizing developmental potential. It is during the last trimester of pregnancy when brain development accelerates (1, 2) and where accumulation of docosahexaenoic acid (DHA) in neural tissues occurs most rapidly (1, 3). Dietary intake and maternal stores of DHA during pregnancy and lactation have important implications for the developing brain. Uncertainty surrounding the ability of Westernised diets to fulfill requirements of DHA during pregnancy has raised concern for the developmental outcome of children raised in this dietary context (4).

Some children in Australia have very limited language ability, impacting both the individual and society. Intervention for language development during the early years should be a primary focus for research. The role that DHA might play presents as a compelling area of investigation undertaken in this thesis.

This thesis contains a literature review, including a systematic review and meta-analysis, and also proposes a theoretical framework from which to understand the potential variation in language development as a function not only of DHA but also of interacting biological and social variables (**Chapter 1**). The methods used in the current study are detailed (**Chapter 2**). Within a randomised controlled trial design (**Chapter 3**) the current study investigates whether DHA supplementation during the prenatal period has an

effect on language development at 4 years of age. Interactions between DHA and other individually contributing factors posed by the bio-ecological model (**Chapter 4**) and relationships between markers of DHA and language development (**Chapter 5**) are examined. A model proposed to provide a broader or more comprehensive conceptualization of the role of DHA within the larger system of influences on language development was tested (**Chapter 6**).

The current study found no significant effect of DHA supplementation during pregnancy on children's language development at 4 years of age as measured by the primary outcome of the current study: mean Core Language Scores, assessed using the second edition of the Clinical Evaluation of Language Fundamentals Preschool. There were no significant interactions between treatment group and child sex, maternal age, in utero exposure to maternal cigarette smoking or alcohol consumption, or maternal depression. There was, however, a significant interaction for maternal education. There was also no significant relationship between markers of DHA status and language development for the whole group, and no significant difference in language development between those with cord blood DHA in the 25th and 75th percentile. There were, however, both significant positive and negative relationships between the number of fish meals and DHA foods (respectively) the child consumed in the month prior to the 4-year assessment and language development at 4 years of age. Findings from structural equation modelling analyses provided no support for understanding the relationship between DHA and children's language

development through focusing on the relationships proposed by the bio-ecological model.

Overall, findings suggest that prenatal DHA supplementation does not benefit children's language development. Longer-term follow-up of early DHA supplementation is required to determine whether delayed effects emerge.

DECLARATION

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Nicola Gawlik

21 June 2016

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GLOSSARY

AA	Arachidonic Acid
AEDC	Australian Early Development Census
AEDI	Australian Early Development Index
AI	Adequate Intake/s
ALA	Alpha linolenic Acid
ASQ	Ages and Stages Questionnaire
Bayley-II	Bayley Scales of Infant Development, Second Edition
Bayley-III	Bayley Scales of Infant Development, Third Edition
BRIEF-P	Behaviour Rating Inventory of Executive Function– Preschool
BW	Birth Weight
C	Capsule
CA	Corrected Age
CBCL	Child Behaviour Checklist
CELF P-2	Clinical Evaluation of Language Fundamentals Preschool, Second Edition
CFI	Comparative Fit Index
CI	Confidence Interval
CLAMS	Clinical Linguistic and Auditory Milestone Scale
CLS	Core Language Score
CNS	Central Nervous System
Ctrl	Control
d	Day/s

DAS-II	Differential Abilities Scales, Second Edition
DHA	Docosahexaenoic Acid
Diff	Difference
DNBC	Danish National Birth Cohort
DNS	Day Night Stroop
DOMInO	DHA to Optimise Mother Infant Outcomes
DPA	Docosapentaenoic Acid
Egg-DTG	Egg-Derived Triglyceride
ELVS	Early Language in Victoria Study
EP	Egg Phospholipid
EPA	Eicosapentaenoic Acid
EV	Expressive Vocabulary
F	Formula
FA	Fatty Acid/s
FAD GF	Family Assessment Device – General Functioning subscale
FAS	Fetal Alcohol Syndrome
FASD	Fetal Alcohol Spectrum Disorders
FMC	Flinders Medical Centre
FO	Fish Oil
g	Grams
GA	Gestational Age
GMDS	Griffiths Mental Development Scales
GP	General Practitioner

H	Hypothesis
HM	Human Milk
HSQ	Home Screening Questionnaire
ICU	Intensive Care Unit
IQ	Intelligence Quotient
Kg	Kilograms
KPS	Knobloch, Passamanick, & Sherrard's Developmental Screening Inventory
LA	Linolenic acid
LCPUFA	Long-Chain Polyunsaturated Fatty Acid/s
M	Mean
MRI	Magnetic Resonance Imaging
MCDI	MacArthur-Bates Communicative Development Inventories
mg	Milligrams
MLU	Mean Length of Utterance
N	Number
n-3	Omega-3
ND	None Detected
NEPSY	NEuroPSYchological Assessment
NHMRC	National Health and Medical Research Council
NR	Not Reported
PPCT	Person Process Context Time
PPVT	Peabody Picture Vocabulary Test
PPVT-R	Peabody Picture Vocabulary Test, Revised

PPVT-III	Peabody Picture Vocabulary Test, Third Edition
Preg	Pregnancy
RBC	Red Blood Cell
RCT	Randomised controlled trial/s
RLE	Recent Life Events
SD	Standard Deviation
SDQ	Strengths and Difficulties Questionnaire
SS	Sentence Structure
SSRI	Selective Serotonin Reuptake Inhibitor
TLI	Tucker and Lewis Index
Trt	Treatment
UK	United Kingdom
USA	United States of America
Veg	Vegetable
VIQ	Verbal IQ
VLBW	Very Low Birth Weight
WASI	Wechsler Abbreviated Scale of Intelligence
WCH	Women's and Children's Hospital
WIAT-II	Wechsler Individual Achievement Test, Second Edition
WISC-III	Wechsler Intelligence Scale for Children, Third Edition
Wk	Week/s
WMD	Weighted Mean Difference
WPPSI-R	Wechsler Preschool and Primary Scale of Intelligence – Revised

WPPSI-III	Wechsler Preschool and Primary Scale of Intelligence, Third Edition
WS	Word Structure
y	Year/s

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