

Fish Oil in Pregnancy Study: Can we improve metabolism and reduce obesity risk for children of women with overweight or obesity?

A Better Start 2022

Dr Ben Albert

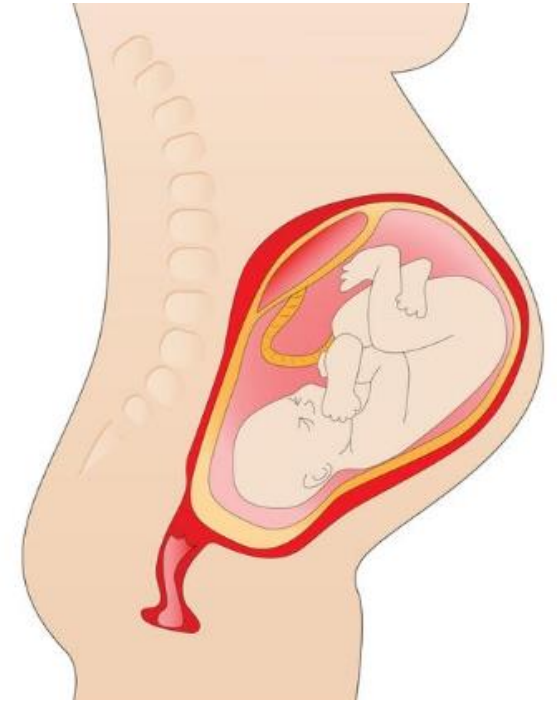
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Background

Maternal pre-pregnancy obesity is the greatest predictor of obesity in children

Likely mediated by insulin resistance and elevated lipids (and glucose) in pregnancy → fetal over-nutrition

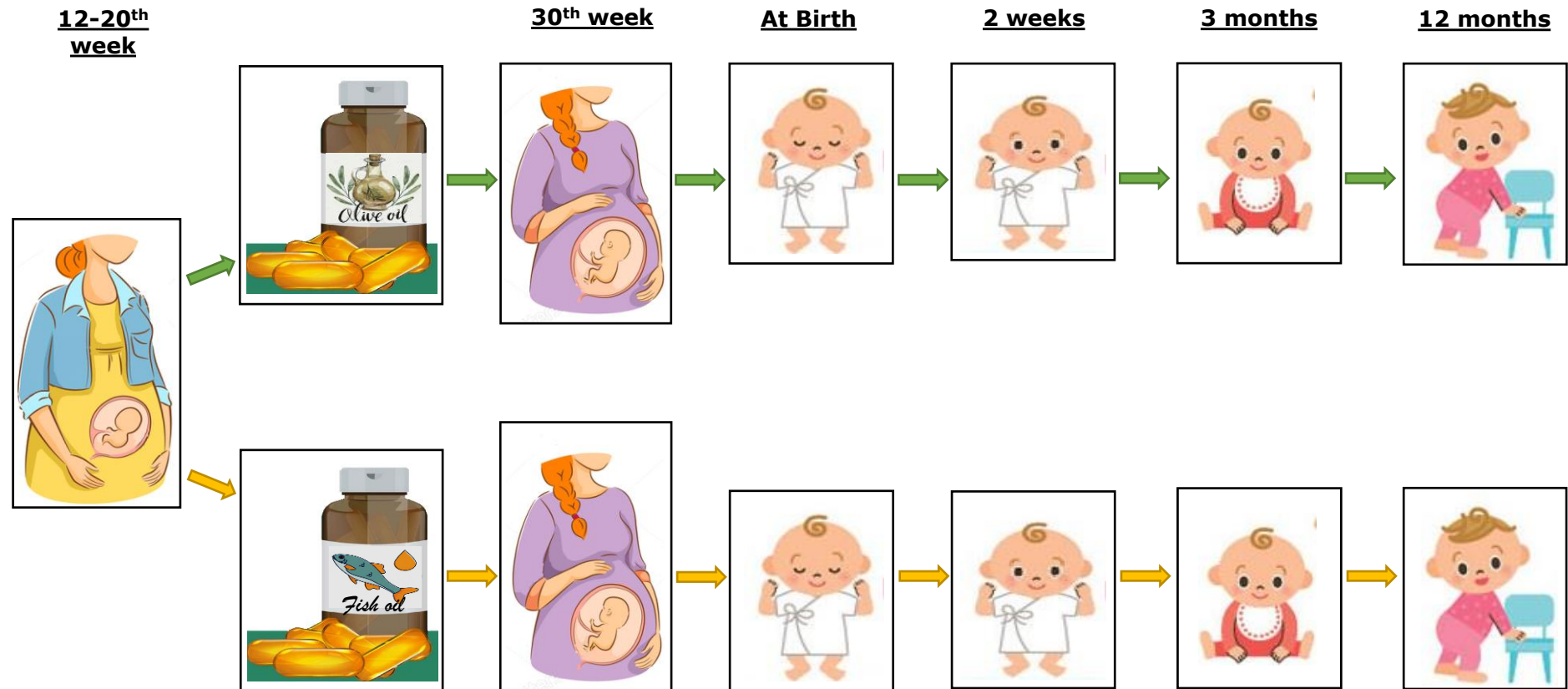
Omega-3 fats in fish oil are insulin sensitising and lower triglycerides



Hypothesis

We hypothesised that maternal fish oil consumption of women with overweight or obesity would improve maternal metabolism and lower body fat in infants

Study Design



Overweight/obese pregnant women recruited at 12-20 weeks.

6 capsules/ day (3g of n-3 PUFA in the fish oil group).

Primary Outcome:
Percentage body fat in the baby of **2 weeks** by **DXA** scan.

Secondary outcomes:
Auxological measures: **At birth, 2 weeks, 3 months, and 12 months.**

Fasting glucose, insulin, lipid profile, HOMA-IR

Eligibility criteria: BMI ≥ 25 kg/m², 12-20 weeks of gestation, 18-40 years, singleton pregnancy

Demographics

	Fish Oil	Olive Oil (Control)
n	66	63
Age at trial entry (years)	33.1 [29.4, 35.9]	33.2 [28.2, 35.0]
Weight (kg)	90.6 ± 15.8	93.0 ± 20.7
BMI (kg/m ²)	32.8 ± 5.3	33.5 ± 7.1
Overweight [n (%)]	20 (30.3%)	23 (36.5%)
Obesity	46 (69.7%)	40 (63.5%)
Ethnicity [n (%)]		
Maori	11 (17%)	7 (11%)
Pacific	9 (14%)	10 (16%)
NZ European	35 (53%)	36 (57%)
Asian	2 (3%)	5 (8%)
Indian	7 (11%)	4 (6%)
Other	2 (3%)	1 (2%)
Gestational age at trial entry (weeks)	17.2 ± 2.1	16.9 ± 2.0

Greater omega-3 levels and lower triglycerides during pregnancy (30 weeks gestation)

	Fish Oil	Olive Oil (Control)
	n=58	n=57
Weight (kg)	96.9 ± 16.3	99.5 ± 21.5
BMI (kg/m ²)	35.0 ± 5.3	35.8 ± 7.3
Systolic BP (mmHg)	108.2 ± 9.5	109.5 ± 9.6
Diastolic BP (mmHg)	66.9 ± 7.6	68.3 ± 7.4
Gestational Diabetes (ADIPS)	6 (9.8%)	2 (3.4%)
Metabolic profile		
HbA1c	4.96 ± 0.45	4.88 ± 0.47
Insulin (uU/ml)	20.8 ± 8.3	18.9 ± 8.3
Glucose (mmol/L)	4.6 ± 2	4.2 ± 2
HOMA-IR	2.26 ± 0.74	2.43 ± 0.7
Triglycerides (mmol/L)	2.26 ± 0.74	2.43 ± 0.7
Free fatty acids (g/L)	0.51 ± 0.14	0.54 ± 0.16
Red cell Omega-3 index	10.4 ± 2.3	6.9 ± 1.6
Red cell n-6:n-3 ratio	1.2 ± 0.4	2 ± 0.4

***p<0.001 vs olive oil

Fish oil group had lower blood loss and lower rates of emergency caesarean section

Maternal outcomes	Fish Oil	Olive Oil (control)
	n=64	n=60
Gestational age at birth (y)	39.4 ± 1.4	39.6 ± 1.5
Hypertension	2 (3%)	4 (8%)
Pre-eclampsia	nil	2 (3.5%)
Mode of delivery		
Vaginal	47 (73%)	32 (53%)
Total c-section	17 (27%)*	28 (47%)
Emergency c-section	6 (9%)*	18 (30%)
Estimated blood loss (ml)	461 ± 324	705 ± 589
Antepartum Haemorrhage	nil	3 (5%)
Postpartum Haemorrhage	12 (19%)	17 (28%)

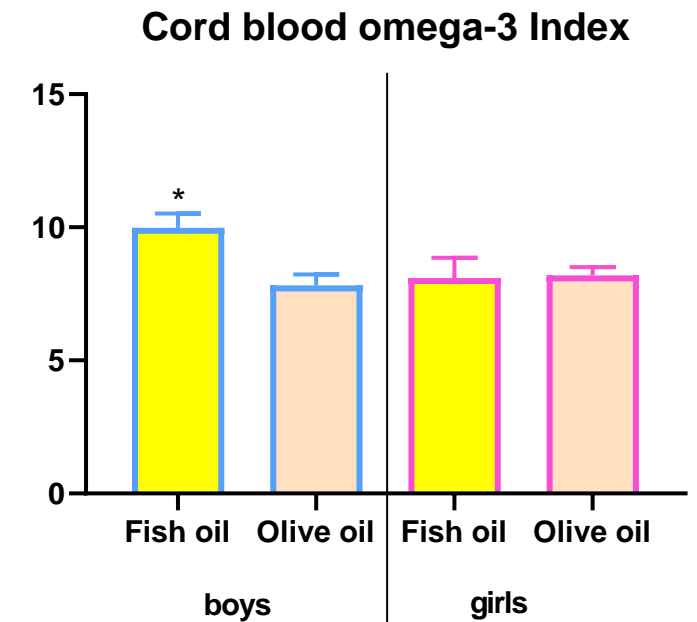
*p<0.05 vs olive oil

No differences in health or measurements at birth

	Fish Oil	Olive Oil (control)
	n=64	n=60
Weight (g)	3574 ± 581	3582 ± 532
Weight Z-score	0.51 ± 1.1	0.40 ± 0.95
Length (cm)	51.4 ± 3.1	51.7 ± 2.5
HC (cm)	34.9 ± 1.5	34.9 ± 1.6
Ponderal index	2.6 ± 0.3	2.6 ± 0.3
Apgar <7 at 5min	1 (2%)	2 (3%)
SGA (<10%ile) for weight	2 (3%)	1 (2%)
LGA (>90%ile) for weight	24 (36%)	20 (32%)
SCBU/NICU admission	7 (11%)	2 (3%)
Hypoglycemia	2 (3%)	1 (2%)
Premature (<37 weeks)	4 (6%)	2 (3%)
Post-term (>42 weeks)	nil	1 (1.6%)
Jaundice requiring treatment	3 (6%)	2 (3%)

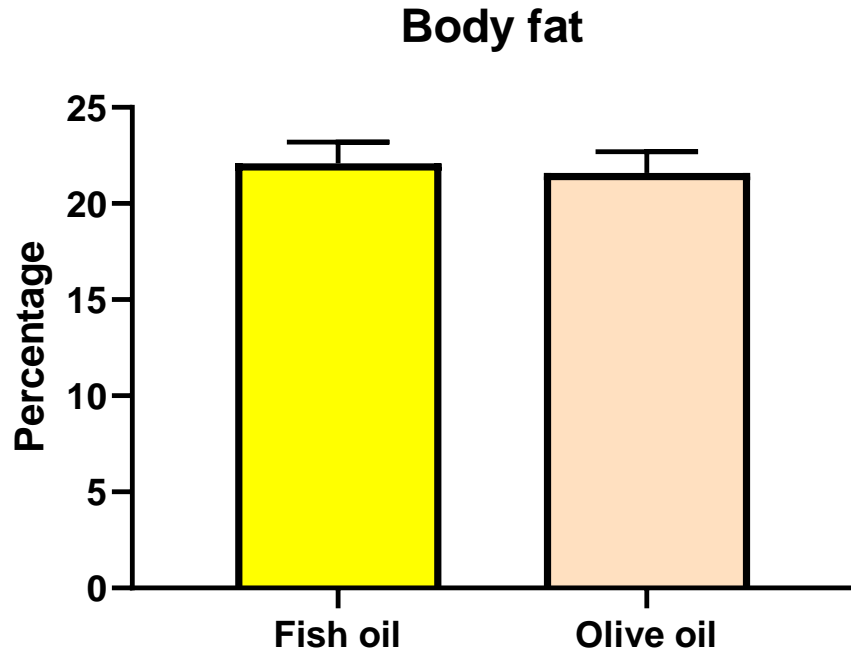
Fish Oil led to greater omega-3 levels and IGF-1 in cord blood

	Fish Oil	Olive Oil (control)
	n=39	n=24
Glucose (mmol/L)	3.9 ± 0.2	3.6 ± 0.2
Insulin (uU/L)	8.2 [4.1, 13.8]	7.1 [4.7, 12.7]
HOMA-IR	1.3 [0.7, 2.4]	1.1 [0.6, 1.9]
C-peptide	1.9 [1.4, 3.1]	2.4 [1.9, 2.9]
IGF-1 (ng/ml)	83 [70, 120]*	70 [70, 72]
Leptin (ug/ml)	18.6 [9.7, 37.3]	31.5 [11.5, 50.2]
Adiponectin (mg/ml)	41.9 ± 15.3	46.3 ± 17
Red cell Omega-3 index (%)	9 ± 3.1	8 ± 1.2
Red cell n-6: n-3 ratio	2.5 ± 1.0	2.9 ± 0.4



*p<0.05 vs olive oil

Primary Outcome: Fish Oil supplementation did not affect percentage body fat at 2 weeks of age

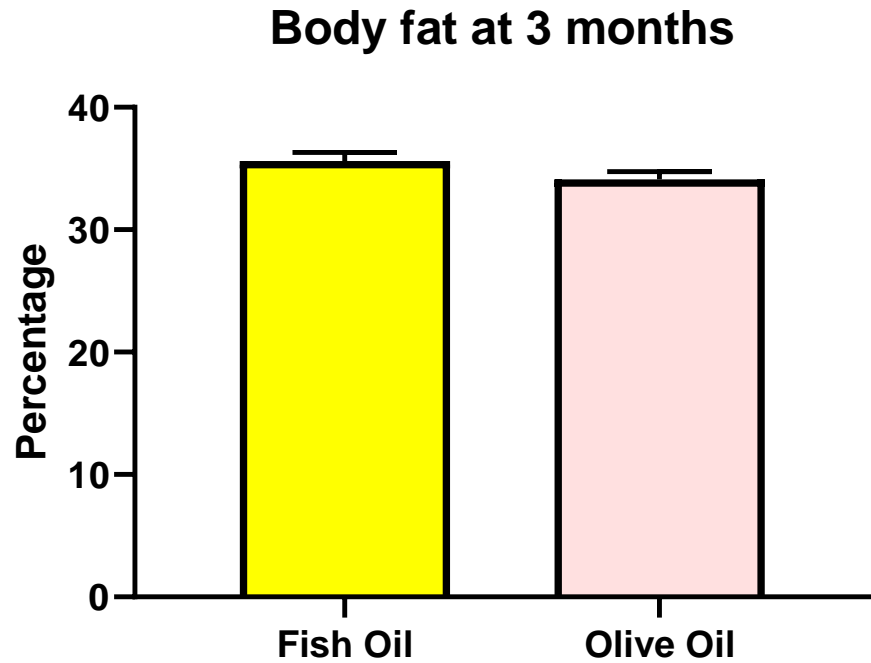


	Fish Oil n=49	Olive Oil (control) n=56
Weight (kg)	3.78 ± 0.62	3.79 ± 0.55
Weight Z-score	-0.01 ± 1	-0.04 ± 0.99
Length (cm)	53.0 ± 2.4	53.5 ± 2.3
HC (cm)	36.4 ± 1.4	36.4 ± 1.3
AC (cm)	33.9 ± 2.5	34.4 ± 2.6
Ponderal index	2.52 ± 0.22	2.47 ± 0.22

Missing data estimated through multiple imputations
Total n=129

Data = means ±SD

Fish oil group had a greater ponderal index, but similar body fat at 3 months of age

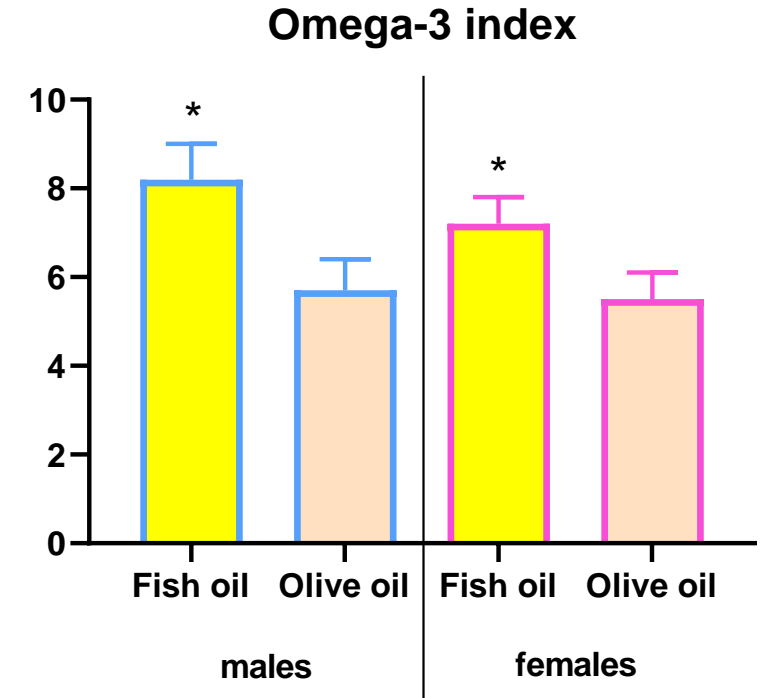


	FO (treatment)	OO (control)
	n=48	n=51
Weight (g)	6.6 ± 0.9	6.3 ± 0.8
Weight Z-score	0.25 ± 1.05	-0.15 ± 0.99
Length (cm)	62.9 ± 2.8	62.8 ± 2.6
HC (cm)	41.2 ± 1.4	40.9 ± 1.6
AC (cm)	41.7 ± 2.9	40.8 ± 2.6
Ponderal index	2.63 ± 0.29	2.51 ± 0.21

*p<0.05 vs olive oil

Fish oil supplementation led to greater omega-3 levels in 3 month old babies and lower triglycerides

	FO (treatment) n=45	OO (control) n=49
Glucose (mmol/L)	4.7 ± 0.5	4.7 ± 0.4
Insulin (µU/L)	6.4 [5.2, 9]	7.2 [4.9, 8.9]
HOMA-IR	1.8 ± 1.5	1.7 ± 1
Leptin (µg/ml)	6.4 ± 3.1	6.8 ± 2.8
Adiponectin (mg/ml)	34.7 ± 7.8	34.1 ± 7.1
Triglycerides (mmol/L)	1.5 [1.2, 2]*	1.9 [1.4, 2.5]
Free fatty acids (mmol/L)	0.65 ± 0.16	0.68 ± 0.15
Red cell Omega-3 index (%)	7.7 ± 3.7**	5.6 ± 2.5
Red cell n-6:n-3 ratio	1.7 ± 0.7**	2.2 ± 0.7



*p<0.05, **p<0.005 vs olive oil

Conclusions

- Fish oil supplementation to mothers with overweight and obesity during pregnancy did not lower the body fat percentage in the infants at two weeks of age.
- This is the first study to show that fish oil supplementation can lower plasma triglyceride levels in mothers with overweight or obesity during pregnancy.
- Surprisingly, there were sex specific differences in the cord blood omega-3 index. Omega-3 levels only increased in cord blood of male infants
- Both sexes had reduced triglycerides at 3 months of age – does this matter?
- The rates of emergency c-section were lower in the fish oil group – is this real?

Future prospects



12 month infants
data analysis



Fish Oil in Pregnancy study – 3
year Follow-up

Breastmilk analysis



DNA methylation
analysis from
infant leucocytes



Qualitative Kaupapa Maori
methodology study of
experiences of Maori and
Pasifika participants

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The 129 women and their families who have been through so much in their journey with us



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