



Effect of 1 year krill oil supplementation on cognitive achievement
in typically developing Dutch adolescents:
Preliminary results

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Research Question

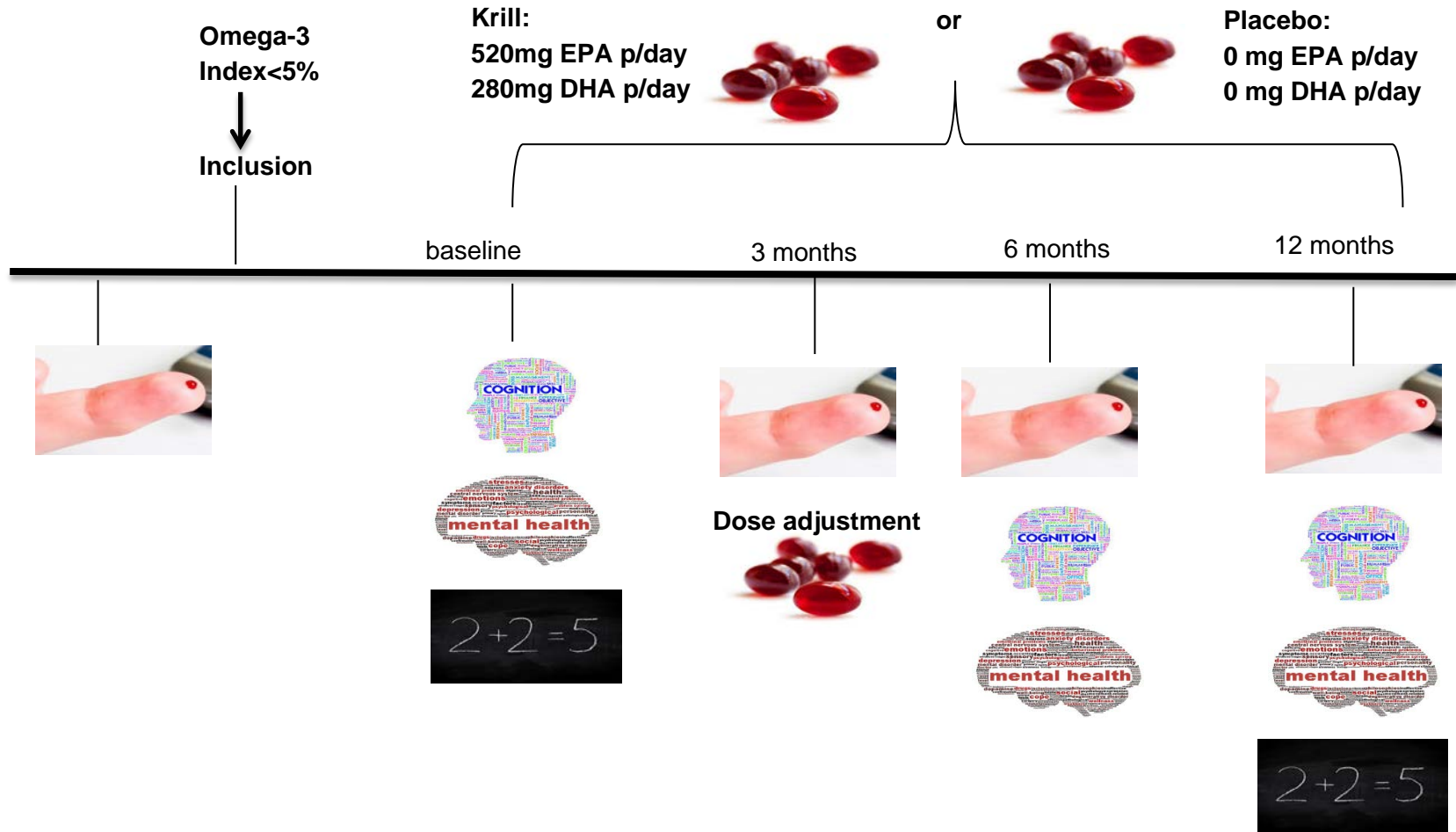
What is the influence of 1 year of krill oil supplementation in 13-15 year old adolescents attending lower general secondary education on:

Cognitive functioning and academic achievement?

Mood and self-esteem?

Sleep quality and quantity and visual processing?

Study design



Cognitive tests

Cognitive test	Measures
Letter digit substitution task	Speed of information processing
D2 test of attention	<ul style="list-style-type: none">• Speed of information processing• Impulsivity• Inattention
Stroop test	Inhibition
Concept shifting test	Shifting
Digit span forward	Short term memory
Digit span backward	Working memory

Unique characteristics

Adolescents

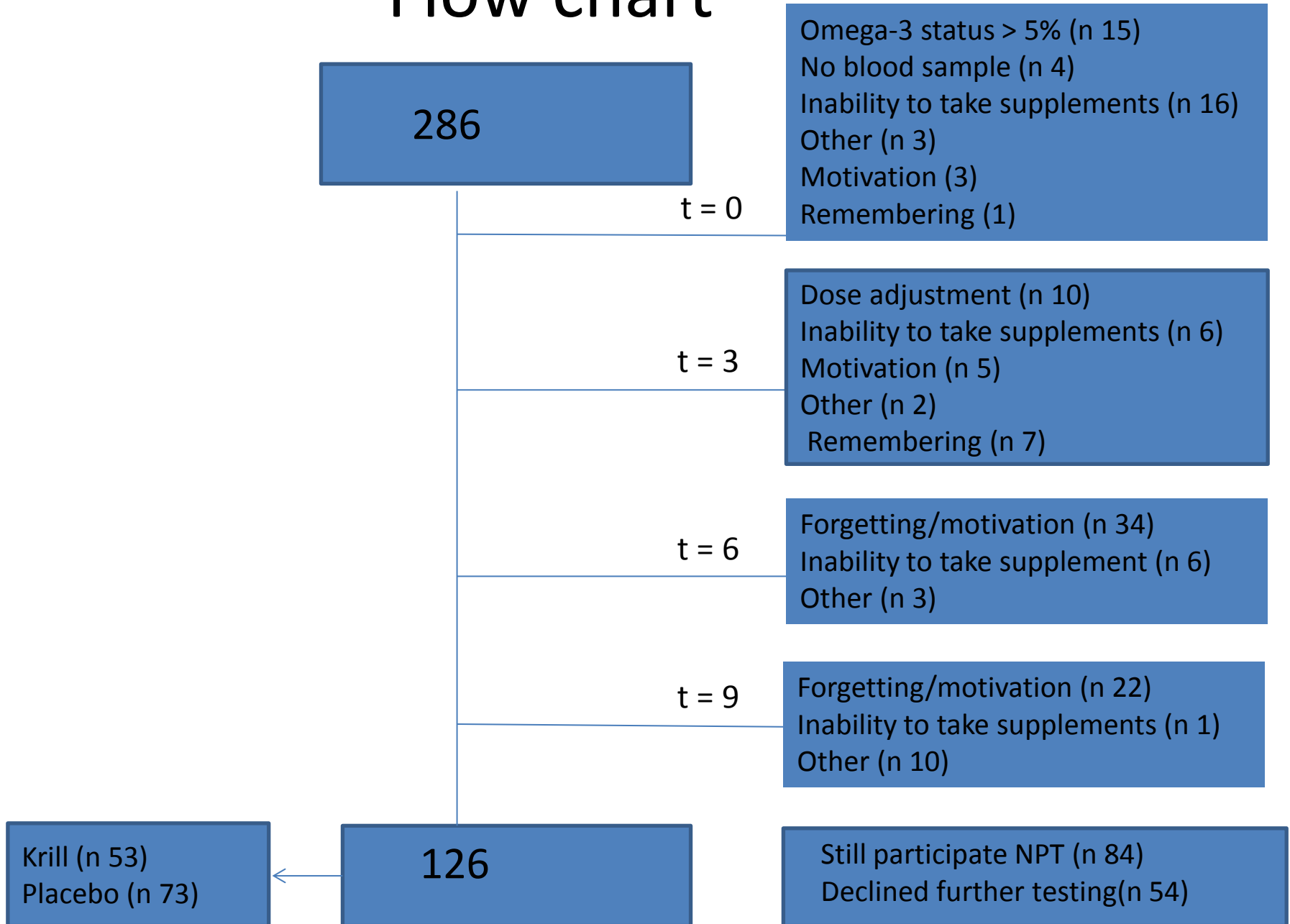
Lower general secondary education
(TL/MAVO)

Selection <5% Omega-3 Index

Personalised dose-adjustment after 3
months

Supplement consumed at dinner time

Flow chart



Baseline characteristics

	Mean \pm SD or N [%]	min	max
Age (years)	14.10 \pm 0.49	13.09	15.44
Male/Female	127/139 [47.7/52.3%]		
Smoking no/yes¹	239/26 [90.2/9.8%]		
BMI	19.93 \pm 3.00	13.7	31.5
Diagnosis yes/no²	69/196 [26/73.7%]		
Alcohol per week³	0.46 \pm 1.77	0	22

¹ Smoking 'yes' was defined as anybody who indicated to smoke more than 0 cigarettes per week.

² Diagnosis was indicated by students themselves and included (but not limited to) dyslexia, dyscalculia, depression, autism and ADHD.

³ Alcohol consumption was asked as how many times per week and units per consumption moment, alcohol per week is defined as these factors multiplied.

Baseline results

A higher Omega-3 Index was associated with better information processing speed.

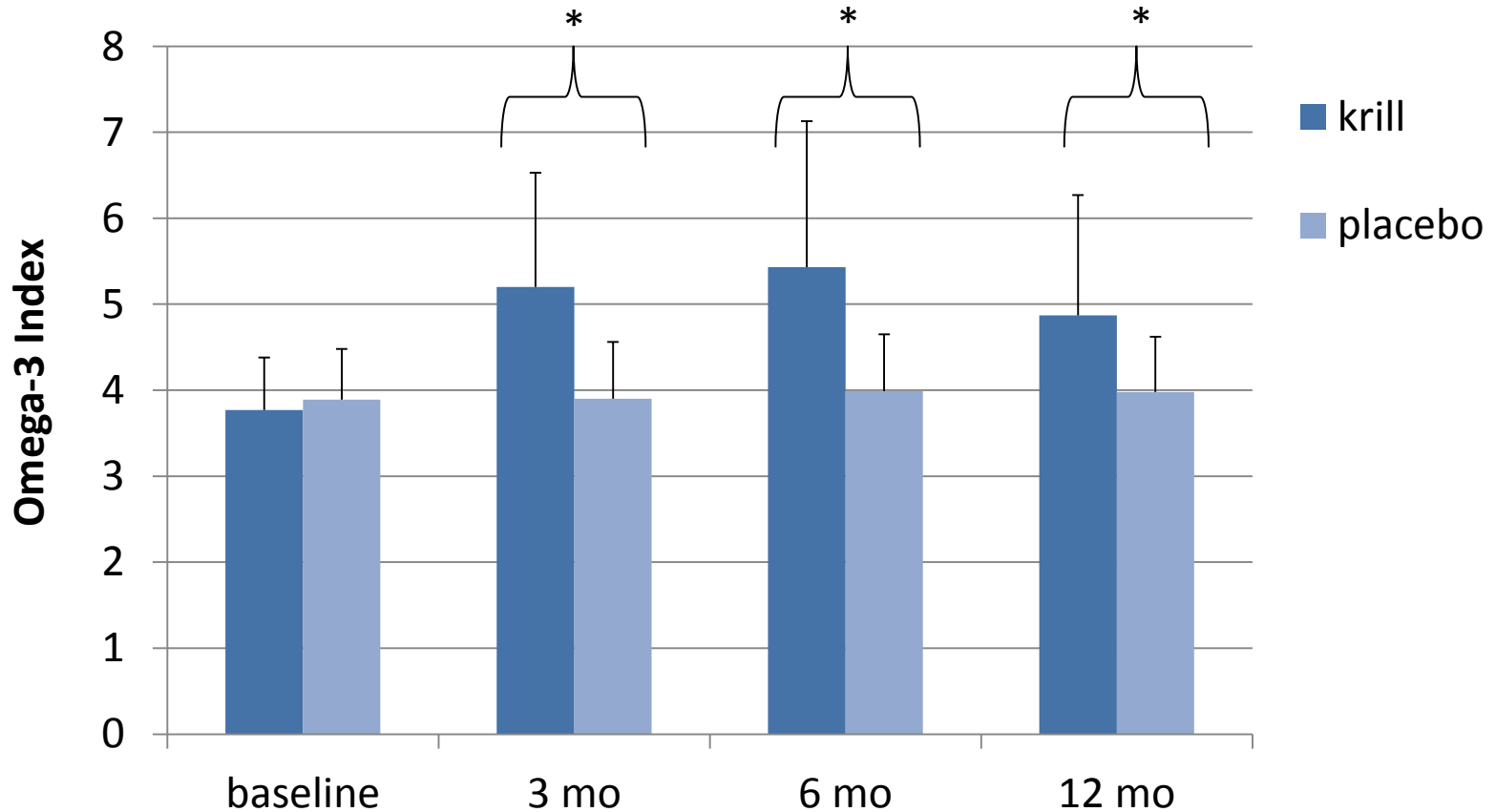
A higher Omega-3 Index was associated with less inattention/impulsivity (i.e. paid more attention)

Change in fatty acids (ITT)

fatty acid (%wt/wt of total FA)	condition	baseline	3 months	6 months	12 months
AA 20:4n-6	Placebo	11.19 ± 1.36	11.00 ± 1.19	11.04 ± 1.51	11.13 ± 1.28
	Krill	11.15 ± 1.16	10.27 ± 1.12*	10.30 ± 1.39 *	10.70 ± 1.48*
EPA 20:5n-3	Placebo	0.39 ± 0.15	0.43 ± 0.15	0.41 ± 0.14	0.41 ± 0.14
	Krill	0.39 ± 0.16	0.95 ± 0.59*	0.99 ± 0.71*	0.75 ± 0.58*
ObA 22:5n-6	Placebo	0.42 ± 0.11	0.41 ± 0.17	0.42 ± 0.09	0.38 ± 0.12
	Krill	0.44 ± 0.10	0.32 ± 0.12*	0.32 ± 0.11*	0.33 ± 0.13*
DPA 22:5n-3	Placebo	1.22 ± 0.20	1.29 ± 0.22	1.30 ± 0.20	1.30 ± 0.19
	Krill	1.23 ± 0.17	1.59 ± 0.34*	1.56 ± 0.35*	1.47 ± 0.31 *
DHA 22:6n-3	Placebo	2.63 ± 0.48	2.63 ± 0.55	2.70 ± 0.54	2.74 ± 0.55
	Krill	2.53 ± 0.52	3.30 ± 0.76*	3.48 ± 0.95*	3.24 ± 0.84*

* Krill oil and placebo condition are significantly different $p < 0.05$

Change in Omega-3 Index over time



* Krill oil and placebo condition are significantly different $p < 0.05$

In comparison

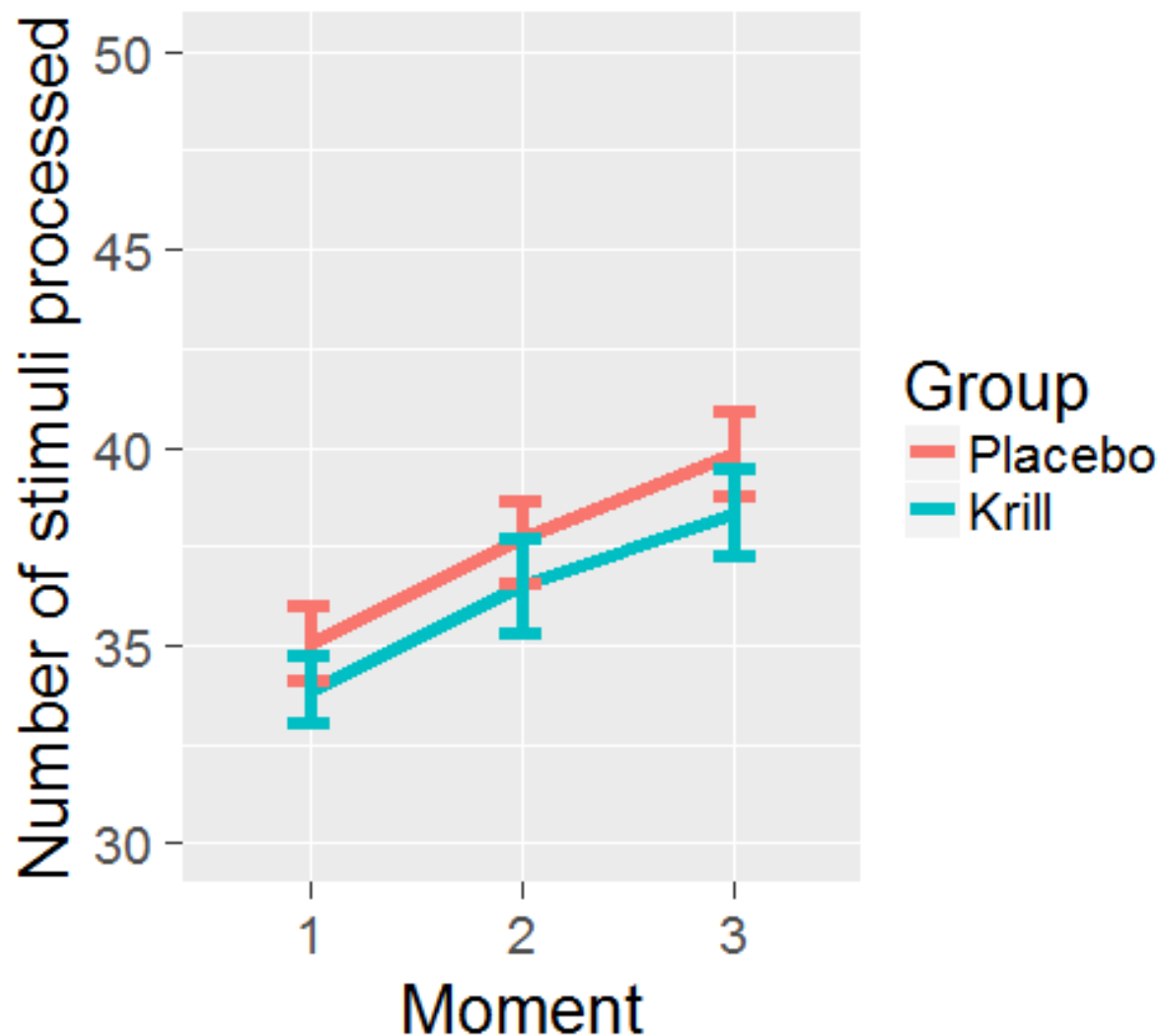
Target group	Omega-3 index
Unselected Japanese men (n 262)	9.58
Unselected Germans (n 5000)	7.15 ± 2.19
Unselected Europeans (n 10000)	6.96 ± 2.15
Framingham-Offspring (n 3196)	4.90 ± 2.10
American adolescents with major depression (n 150)	3.46
Americans with major depression (n 118)	2.90 ± 1.50

Adapted from: Von Schacky , C. Omega-3 index and cardiovascular health. Nutrients 2014;6:799–814.
doi:10.3390/nu6020799

Analyses

- Multilevel analyses – with person as unit
- Intention to treat and blood Omega-3 Index
- Correction for covariates
 - Drinking (units per week)
 - Smoking (yes/no)
 - Age at specific test moment
 - BMI (self-reported at baseline)
 - Sex
 - Cohort number
 - Level of parental education

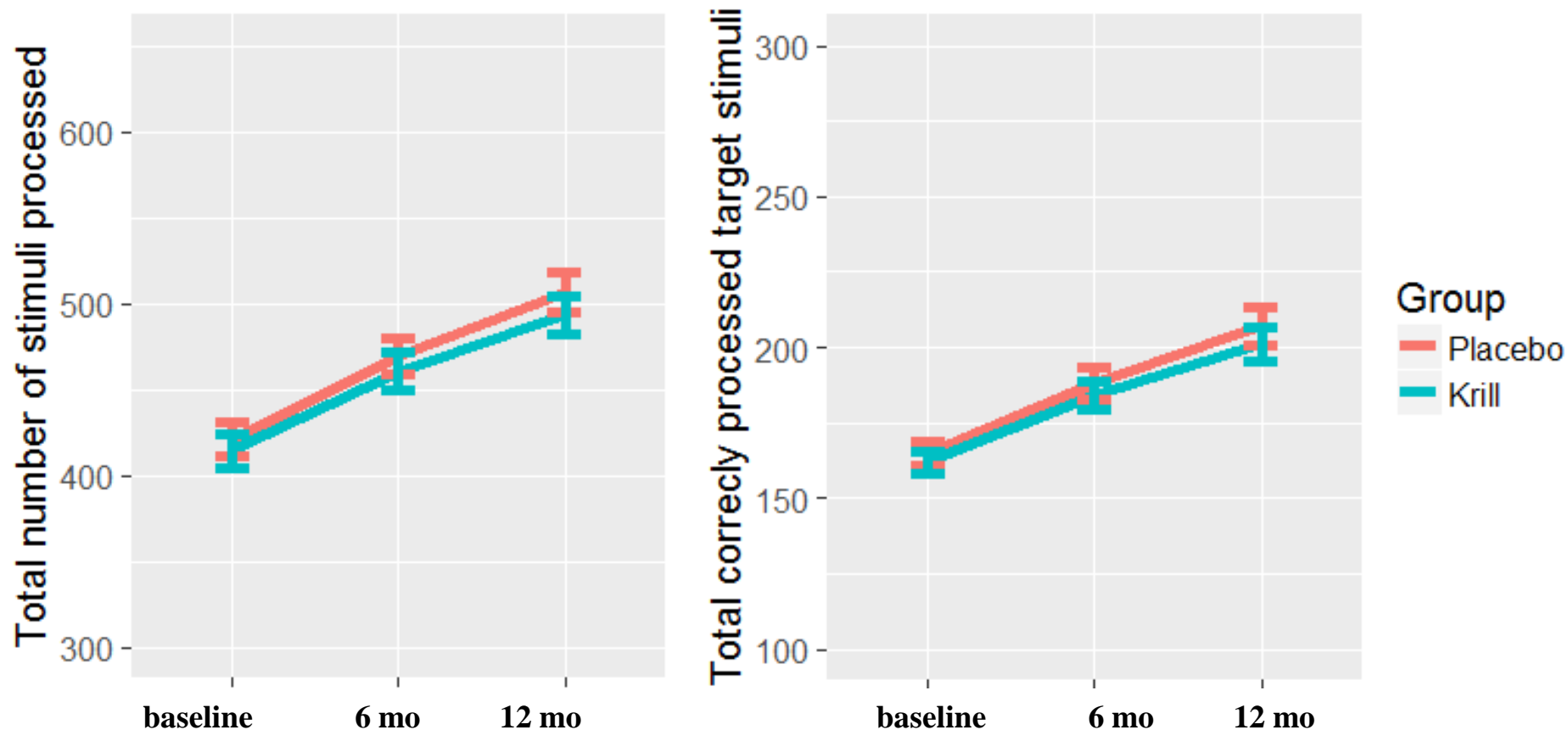
Results speed of information processing



ITT analyses:
 $\beta = -1.28$
 $p = 0.114$
95% CI: -2.84 to 0.28

Omega-3 Index:
 $\beta = 0.02$
 $p = 0.911$
95% CI: -0.33 to 0.37

Results: D2 (1)



ITT analyses:

$\beta = -11.91$

$p = 0.151$

95% CI: -27.84 to 4.04

Omega-3 Index:

$\beta = -1.70$

$p = 0.258$

95% CI: -4.66 to 1.22

ITT analyses:

$\beta = -4.25$

$p = 0.278$

95% CI: -11.79 to 3.29

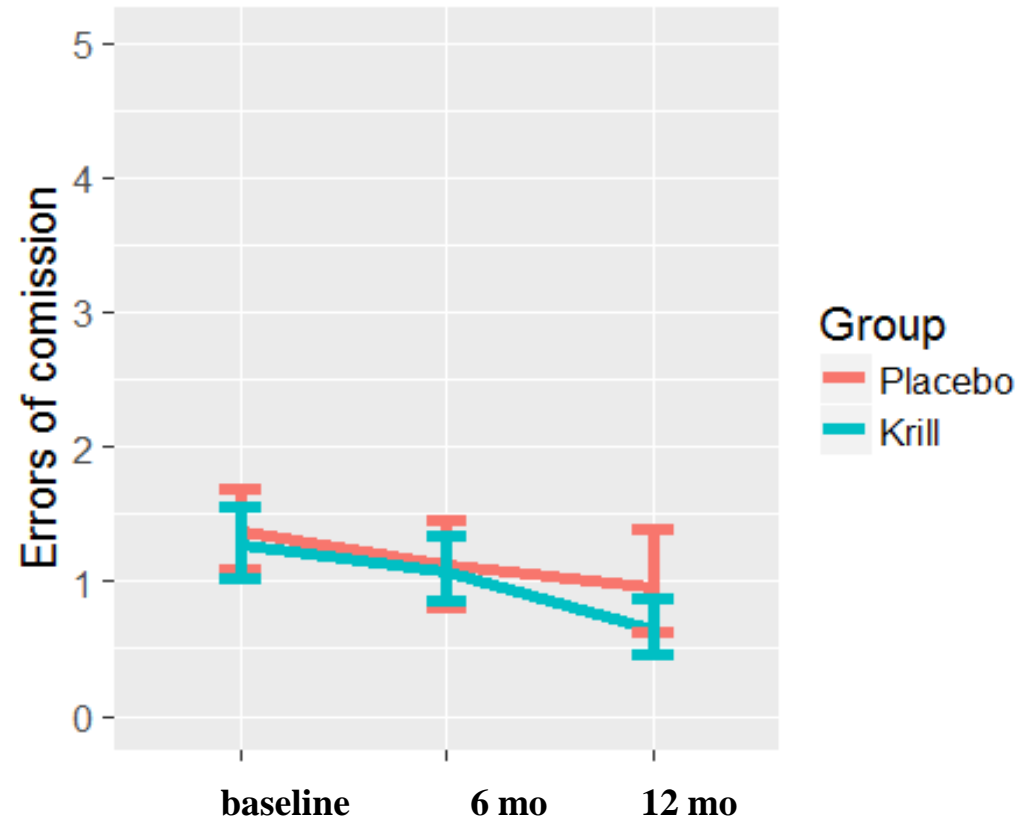
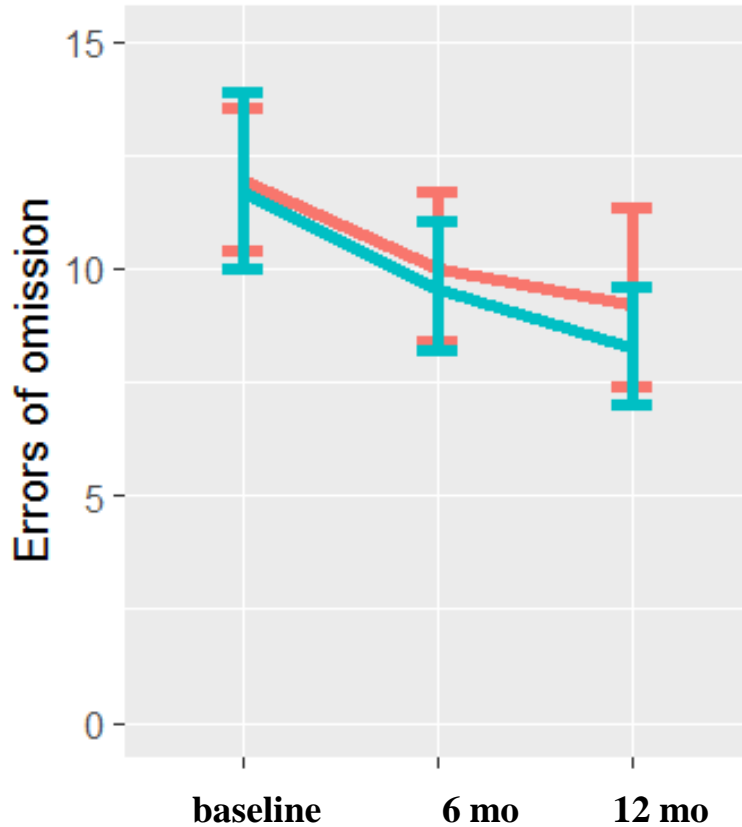
Omega-3 Index:

$\beta = -1.70$

$p = 0.100$

95% CI: -2.37 to 0.20

Results: D2 (2)



ITT analyses:

$\beta = -1.86$

$p = 0.129$

95% CI: -4.21 to 0.49

Omega-3 Index:

$\beta = -0,07$

$p = 0.804$

95% CI: -0.63 to 0.48

ITT analyses:

$\beta = -0.34$

$p = 0.077$

95% CI: -0.70 to 0.03

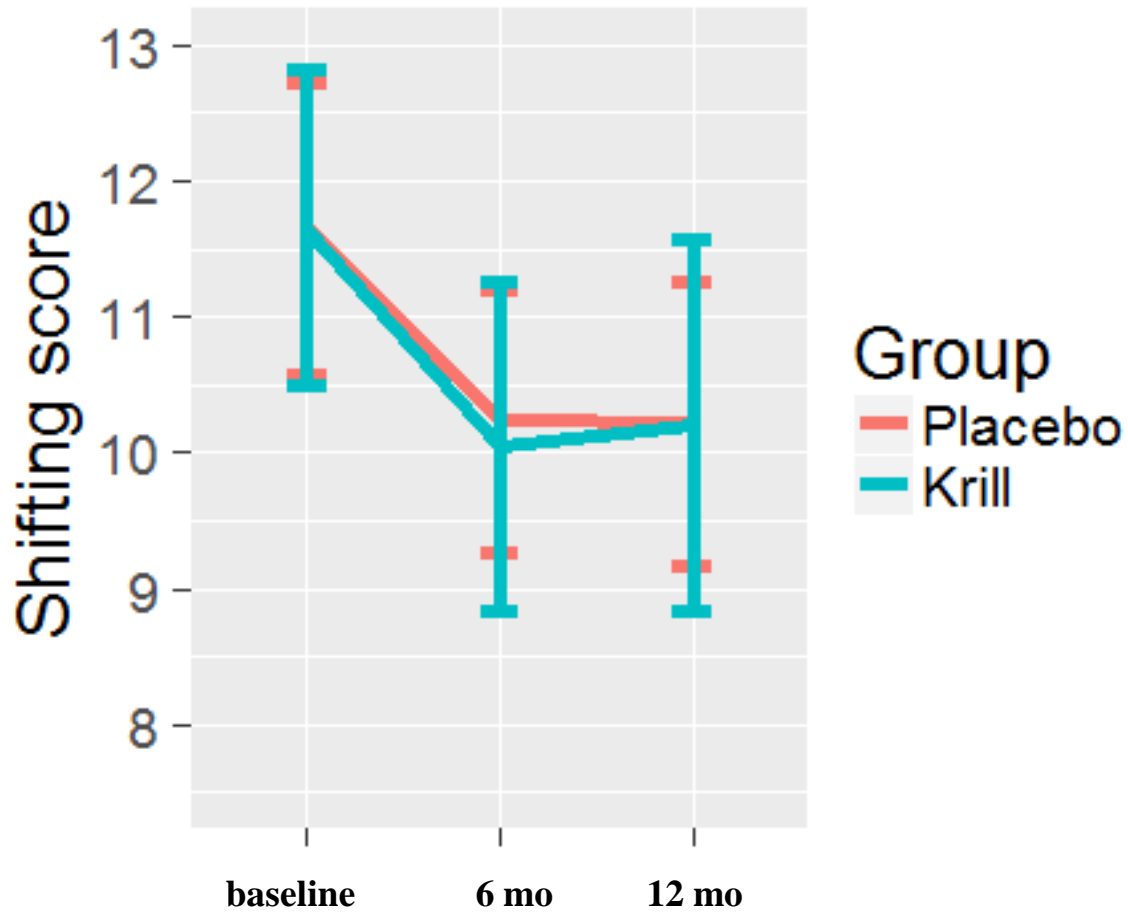
Omega-3 Index:

$\beta = -0.01$

$p = 0.929$

95% CI: -0.12 to 0.11

Results: Shifting



ITT analyses:

$\beta = -0.59$

$p = 0.443$

95% CI: -2.06 to 0.88

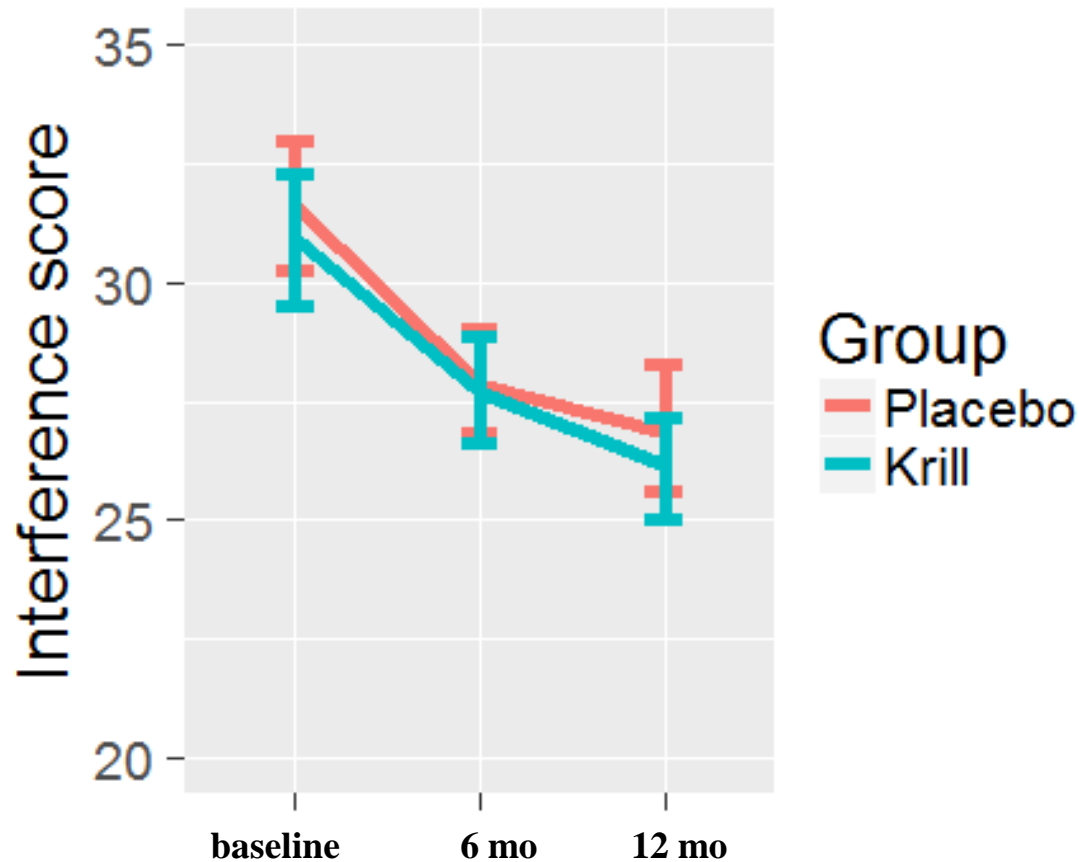
Omega-3 Index:

$\beta = -0.05$

$p = 0.853$

95% CI: -0.53 to 0.44

Results: Interference



ITT analyses:

$\beta = -0.100$

$p = 0.888$

95% CI: -1.26 to 1.46

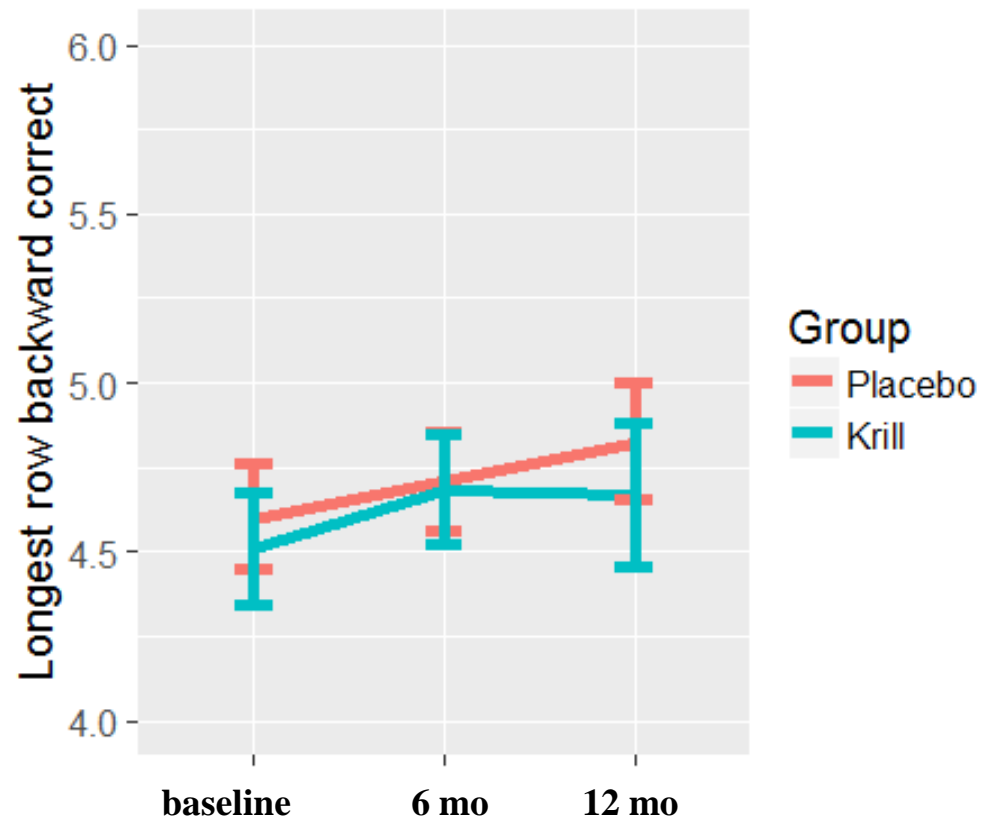
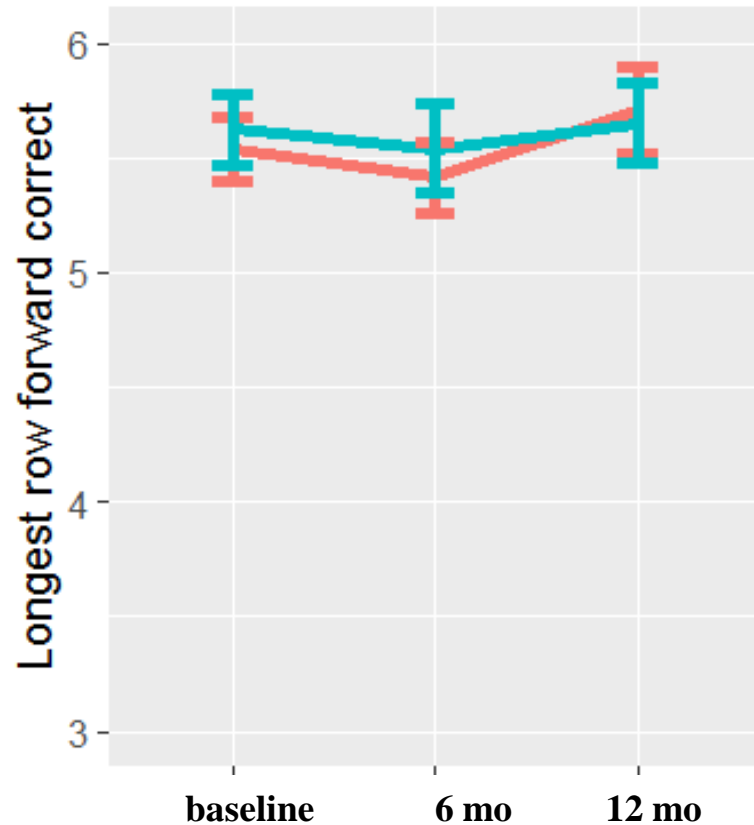
Omega-3 Index:

$\beta = -0.28$

$p = 0.290$

95% CI: -0.78 to 0.23

Results: Digit Span



ITT analyses:

$\beta = 0.03$

$p = 0.793$

95% CI: -0.20 to 0.26

Omega-3 Index:

$\beta = 0.01$

$p = 0.684$

95% CI: -0.05 to 0.08

ITT analyses:

$\beta = -0.03$

$p = 0.759$

95% CI: -0.25 to 0.18

Omega-3 Index:

$\beta = 0.00$

$p = 0.932$

95% CI: -0.07 to 0.07

Discussion (1)

- No significant effects of supplementation on cognitive test performance.
- Even analyses according to omega-3 fatty acid status did not show effects
- 1 year of krill oil, still low Omega-3 Index
 - Did not take capsules – compliance
 - Factors associated with metabolism
 - Krill oil

Discussion (2)

- Further analyses are in progress and other outcome measures (mental well-being, sleep, academic achievement, mental processing).
- Important to take blood values!

Funding

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 - Grant of Dutch Scientific Organisation
 - Aker Biomarine
 - Omegametrix

Publications

- van der Wurff, I., Von Schacky, C., Berge, K., Zeegers, M., Kirschner, P. A., & de Groot, R. (2016). Association between Blood Omega-3 Index and Cognition in Typically Developing Dutch Adolescents. *Nutrients*, 8(1), 13.
- van der Wurff, I. S. M., von Schacky, C., Berge, K., Kirschner, P. A., & de Groot, R. H. M. (2016). A protocol for a randomised controlled trial investigating the effect of increasing Omega-3 index with krill oil supplementation on learning, cognition, behaviour and visual processing in typically developing adolescents. *BMJ open*, 6(7), e011790. doi:10.1136/bmjopen-2016-011790.

Thank you for your attention