HelmholtzZentrum münchen
German Research Center for Environmental Health

Fatty acid composition in blood and obesity in childhood

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Background

Genetic and environmental factors

Childhood obesity

A global major public health challenge:

- prevalence is increasing [1]
- risk factor for obesity and obesity related diseases in adulthood [1]

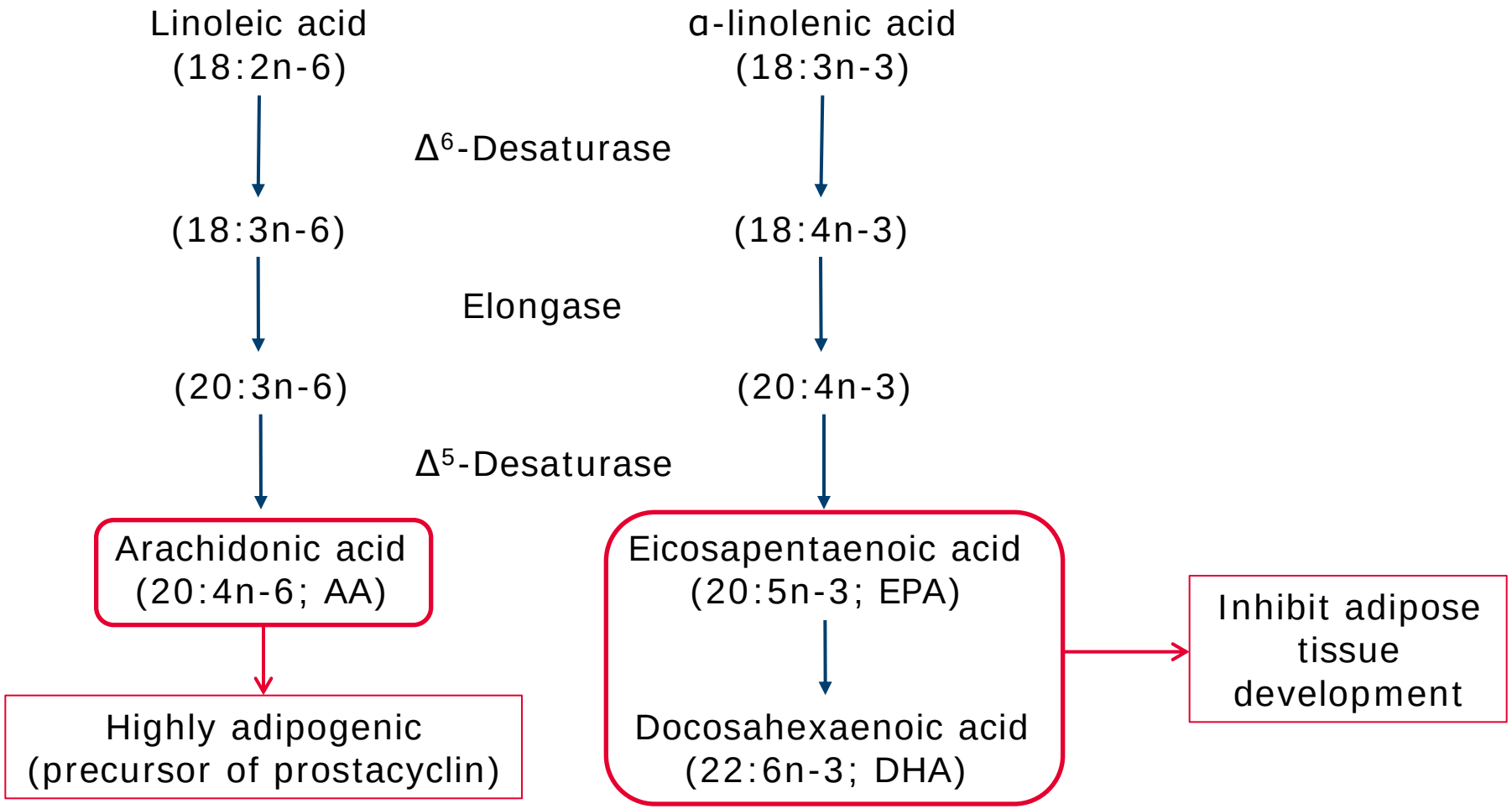
Fatty acids

- No changes in total amount of fat, but altered fatty acid composition [2]
- Especially elevated ratio of n-6/n-3 polyunsaturated fatty acids (PUFA) (n-6/n-3: up to 15:1 or 20:1) [3]

?

1 http://www.who.int/dietphysicalactivity/childhood/en/
2 Ailhaud & Guesnet (2004) *obesity reviews*
3 Simopoulos (2002) *Biomed Pharmacother*

Fatty acid metabolism



Glaser *et al.* (2010) *Metabolism*
Ailhaud *et al.* (2008) *British Journal of Nutrition*

Development of adipose tissue

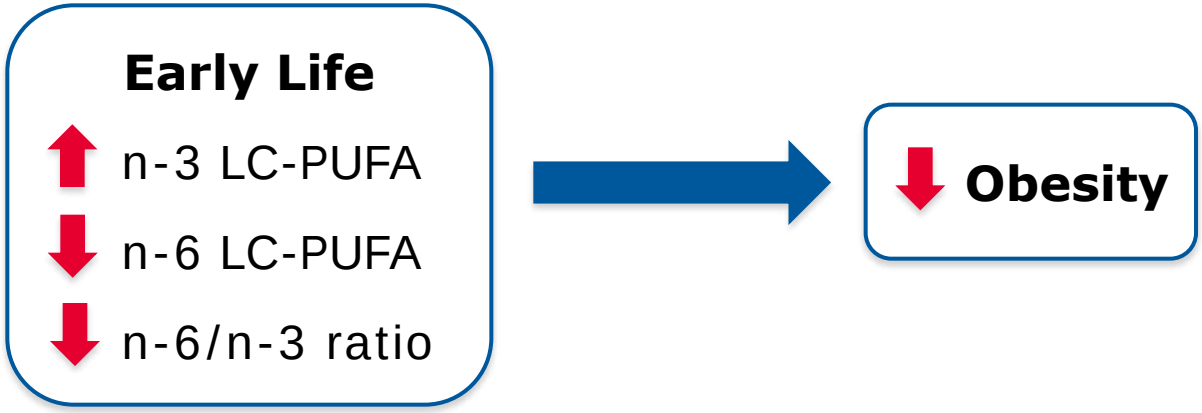
- Adipose tissue development starts at 14th week of gestation and increases exponentially with gestational age.
- Postnatally, the increase in the number and size of adipocytes is high during the first year of life.
- Differentiation of precursor cells into adipocytes also continues later in life.

→ Prenatal and early postnatal life are critical periods for adipose tissue development

Ailhaud & Guesnet (2004) *obesity reviews*
Haggarty (2002) *Placenta*

Hypothesis

High concentrations of n-3 long-chain (LC-) PUFA, low concentrations of n-6 LC-PUFA and a low n-6/n-3 ratio in early life are associated with a lower risk for obesity later in life.



Studies on fatty acids in early life and growth

Interventional

Study	Year	Sample Size
Andersen	2011	n=133
Bergmann	2007 2012	n=144
Courville	2011	n=47
Escolano-Margarit Campoy	2011 2011	n=154
Hauner Much	2012 2013	n=205
Helland	2008	n=143
Lauritzen Asserhøy	2005 2009	n=122
Rosenfeld (MA*)	2009	n=901
Rytter	2011	n=243

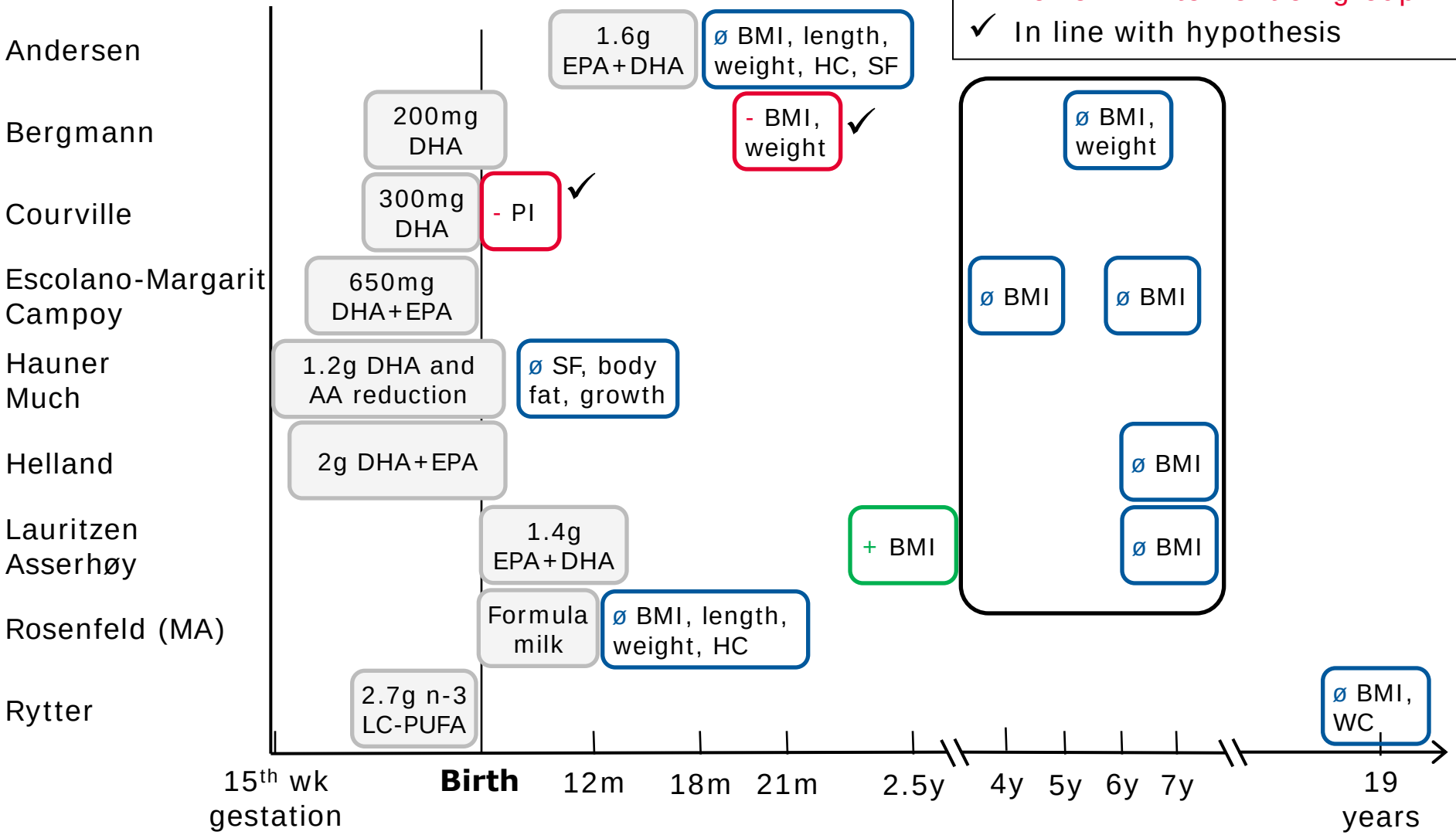
Observational

Study	Year	Sample Size
Donahue	2011	n=302 n=227
Moon	2013	n=293
Standl	2014	n=388

*MA=Meta-Analysis

Interventional studies

ø No effect
\+ Higher in intervention group
\- Lower in intervention group
✓ In line with hypothesis



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HC: head circumference; SF: skinfold thicknesses;
PI: ponderal indices; MA:Meta-Analysis;
WC: waist circumference

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Interventional studies: BMI effect size

Andersen

Bergmann

Courville

Escolano-Margarit Campoy

Hauner

Helland

Lauritzen Asserhøy

Rosenfeld (MA)

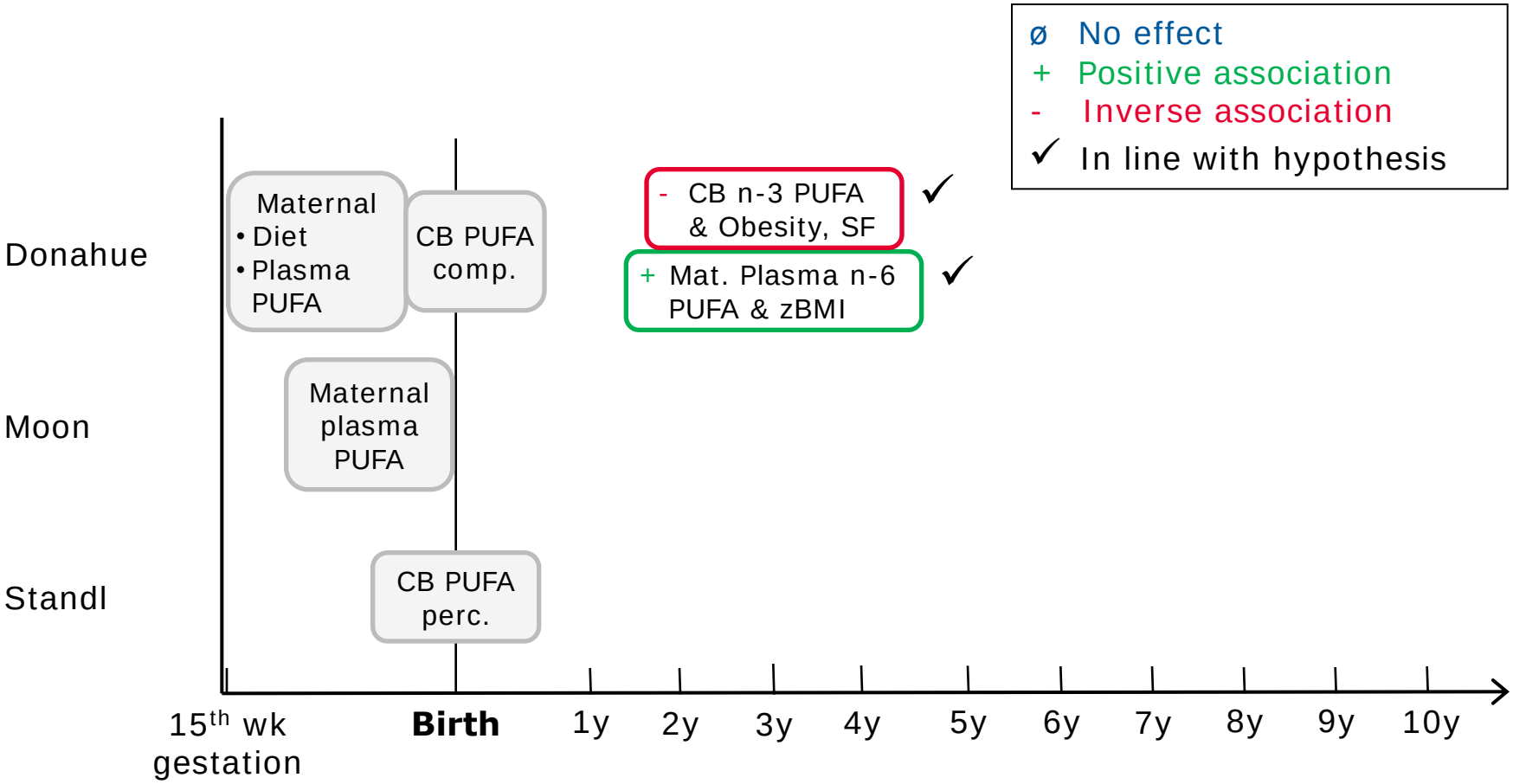
Rytter

Interventional studies: BMI effect size

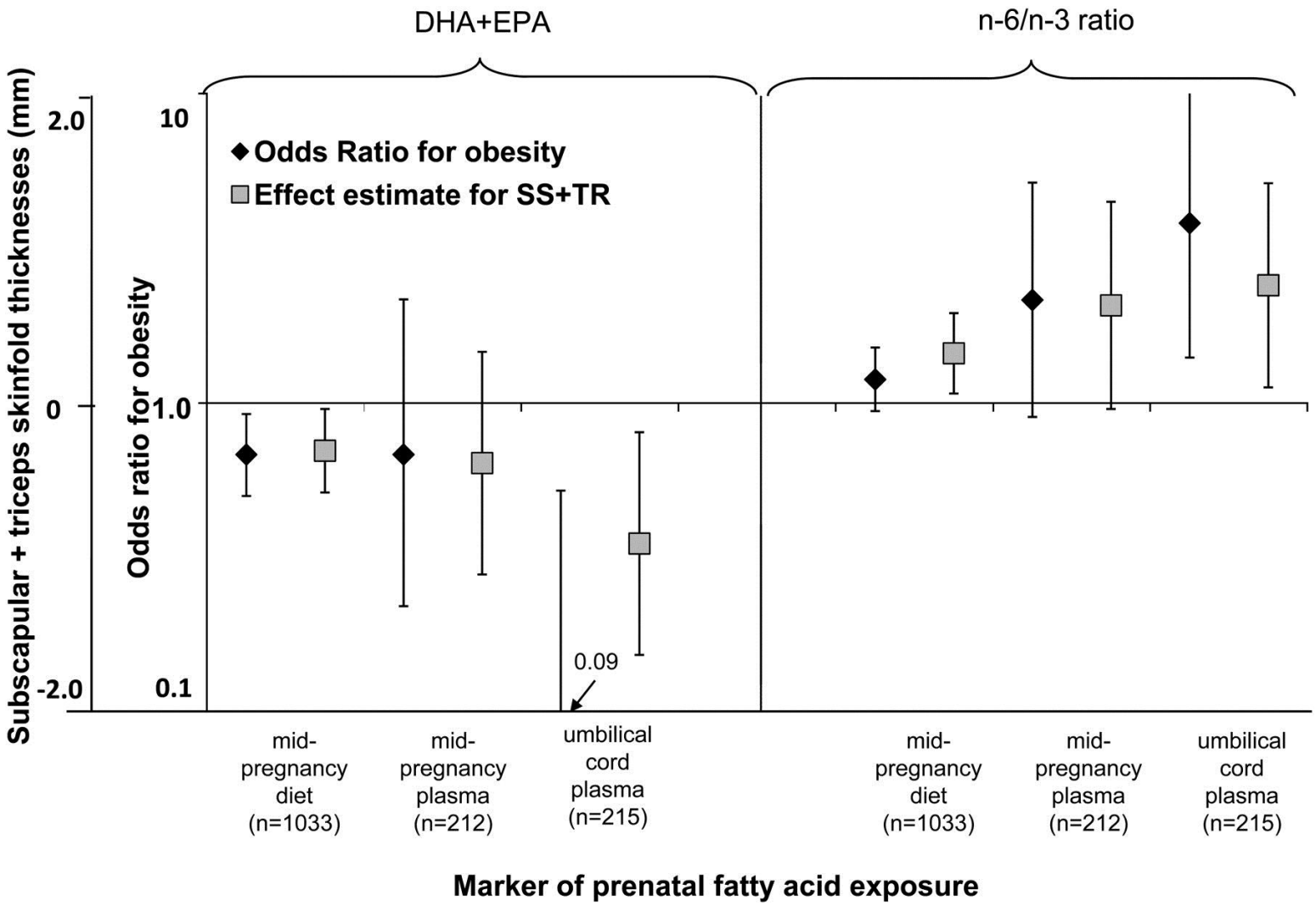
	Age	Outcome	Intervention	Control
Hauner	**12m**	BMI	16.9 (1.5)	16.7 (1.4)
Andersen	**18m**	BMI z-score	0.75 (0.13)	0.70 (0.10)
Rosenfeld (MA)	**18m**	BMI	16.3 (1.4)	16.3 (1.4)
Bergmann	**21m**	BMI	14.7 (0.36)	15.5 (0.38)
Lauritzen	**2.5y**	BMI	16.5 (1.1)	15.9 (1.2)
Escolano-Margarit	**4y**	BMI	16.6 (2.1)	15.8 (1.1)
Bergmann	**6y**	BMI z-score	1.03 (0.10)	1.02 (0.09)
Campoy	**6.5y**	BMI	17.2 (2.9)	16.8 (2.3)
Helland	**7y**	BMI	16.4 (1.7)	16.3 (1.7)
Asserhøy	**7y**	BMI	16.0 (1.6)	15.7 (1.5)
Rytter	**19y**	BMI	22.5 (3.5)	22.6 (3.8)

* $p<0.05$

Observational studies

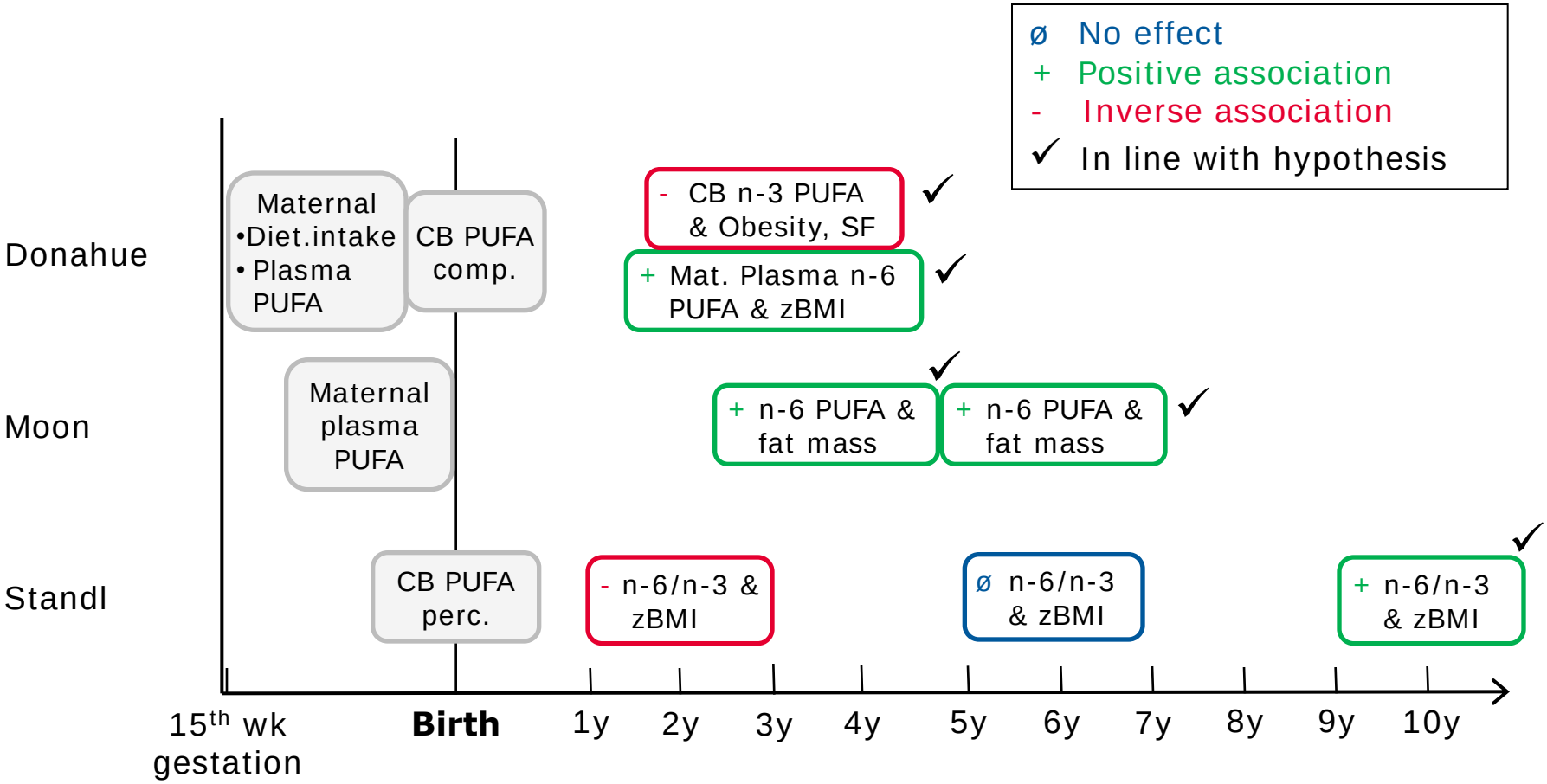


CB: cord blood; SF: skinfold thicknesses; zBMI: BMI z-score



Donahue *et al* (2011) *Am J Clin Nutr*

Observational studies



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Summary & Outlook I/II

- **Interventional studies**
  - **Birth – 2.5 years**: Conflicting results
    - 3 studies: no effect
    - 2 studies: lower weight in intervention group (hypothesis ✓)
    - 1 study: higher weight in intervention group
  - **4 – 7 years**: no effect (4 studies)
  - **19 years**: no effect (1 study)

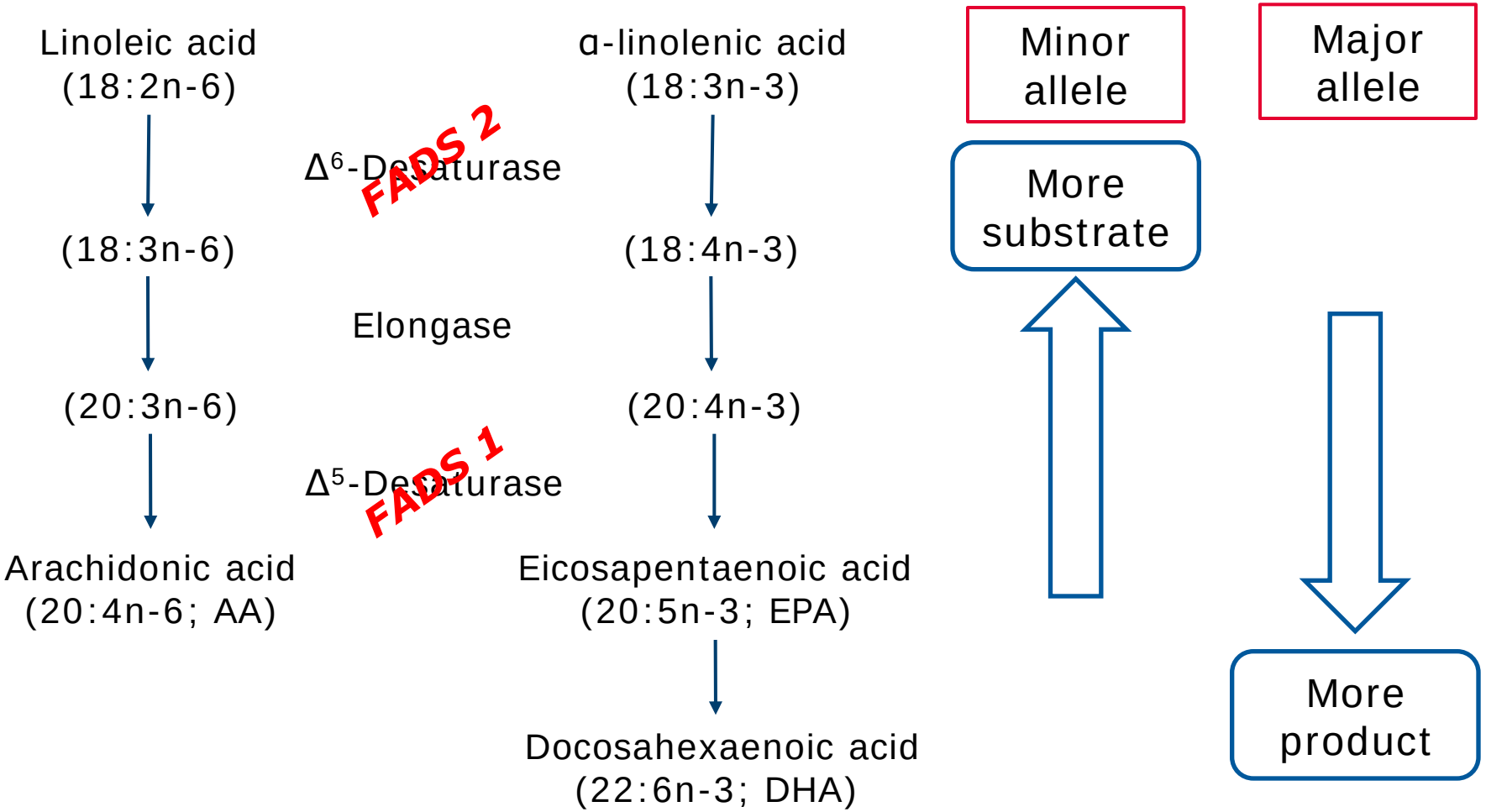
- **Observational studies**
  - **2 studies:** in line with hypothesis
  - **1 study:** time varying effect

Summary & Outlook II/II

- Further interventional studies needed to clarify effect of LC-PUFAs early in life on later weight development
  - Adequate sample size
  - Clarify timing, duration and quantity of intervention
  - Long duration of follow-up to investigate persistence of effect
  - Detailed and repeated measurements of body composition

- Other effect modifying factors?
  - Life-style (diet, physical activity)
  - Include *FADS* genes

Fatty acid metabolism



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➡ **Results on fatty acids and obesity are inconclusive**

Acknowledgements

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