LA VALENZA DEI GRASSI NELL'ALIMENTAZIONE DEL BAMBINO

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OXIDIZED FAT

↓

ENERGY PRODUCTION

STORED FAT

↓

ADIPOSE TISSUE

CIRCULATING FAT

↓

LIPOPROTEINS

FAT IN TISSUE MEMBRANES

↓

FUNCTIONAL DEVELOPMENT

SUBSTRATE UTILIZATION FOR ENERGY

Dynamic coordination of macronutrient balance during infant growth: insights from a mathematical model[1–3]

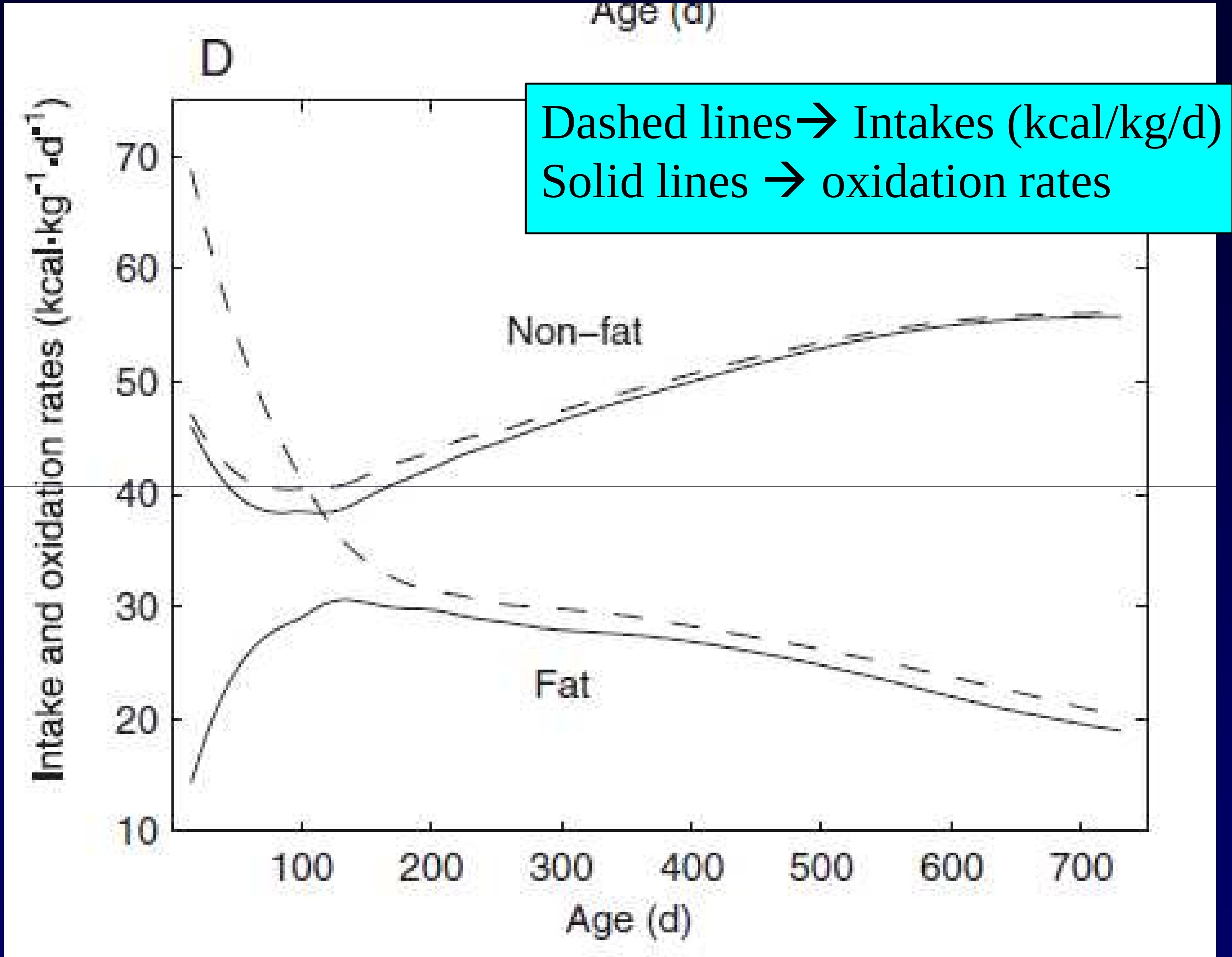
Peter N Jordan and Kevin D Hall

Respiratory quotient
(CO_2 produced/O_2 consumed)

- Fat 0.7
- Protein 0.83
- Sugar 1.0

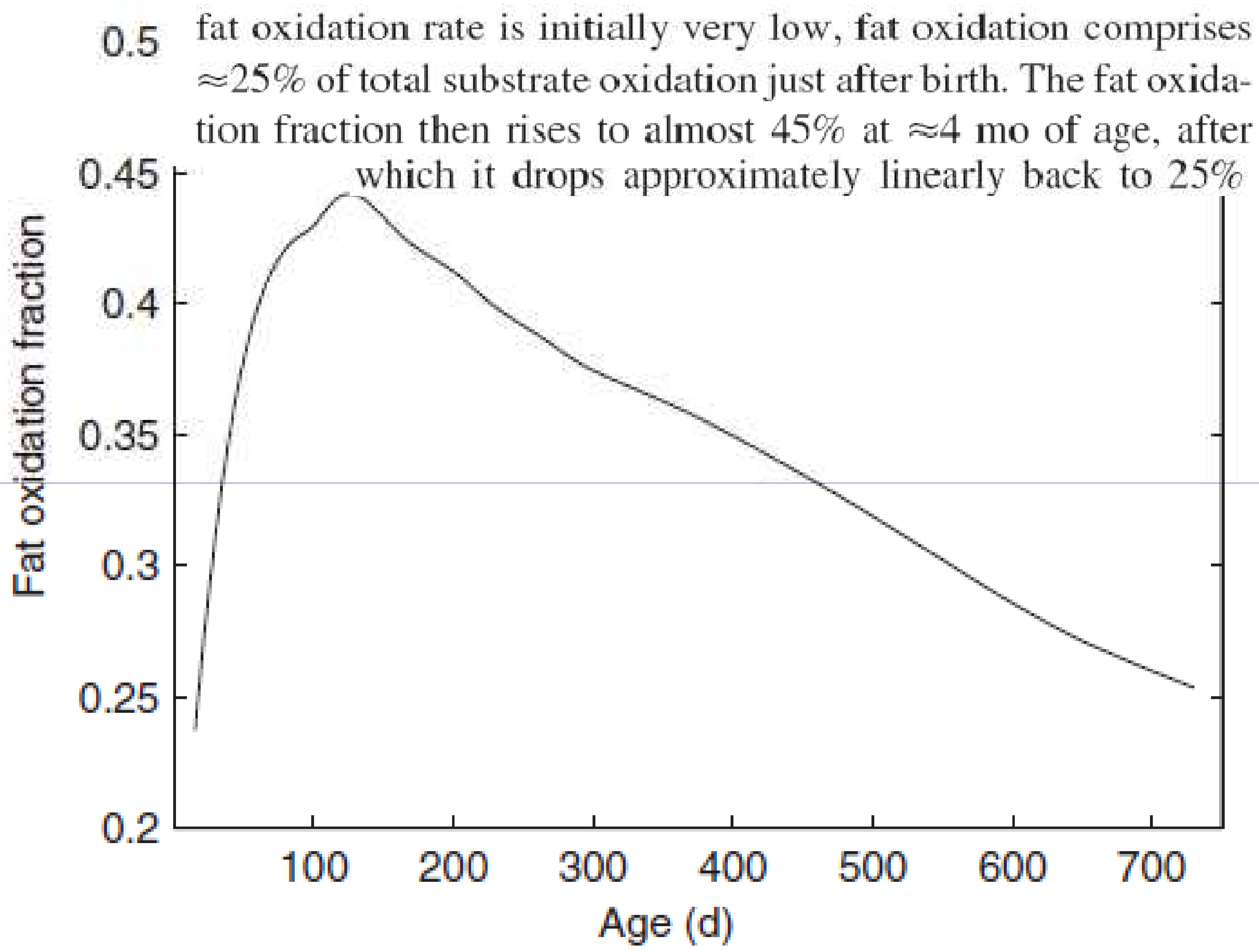
Depending on several factors (basal metabolic rate, growth processes, physical acitivity, neuro-hormonal milieu…..)

Am J Clin Nutr 2008;87:692–703



Age (d)
D
Dashed lines→ Intakes (kcal/kg/d)
Solid lines → oxidation rates
Non–fat
Fat
Intake and oxidation rates (kcal·kg⁻¹·d⁻¹)
70
60
50
40
30
20
10
100
200
300
400
500
600
700
Age (d)

fat oxidation rate is initially very low, fat oxidation comprises ≈25% of total substrate oxidation just after birth. The fat oxidation fraction then rises to almost 45% at ≈4 mo of age, after which it drops approximately linearly back to 25%



GROWTH AND ADIPOSITY

ORIGINAL ARTICLE

International Journal of Obesity (2006) **30**, S50–S57.

Dietary fat and fat types as early determinants of childhood obesity: a reappraisal

- Fat intake decreases from 52 to 45% energy at 4 months to 30% energy at 9-12 months
- Several population-based studies have evaluated the relation between dietary fat intake and body fat in infants and children
- Most studies did not find any association between fat intake during infancy and later indices of adiposity
- Those that established an association emphasize that the association is stronger with fat intakes > 2 years

Country, study name	*Study design*	*Age groups*	*Cohort size*
Infant diet			
Denmark (1991)[56]	Longitudinal	5–10 months	399
Denmark COPENHAGEN study (1987–1989)[32]	Prospective/ Observational	0–1 year	146
Infant/children diet			
USA[57]	Prospective	3 months–2 years	78
USA[58]	Prospective	0–2 years	76
Italy (1991–1996)[59]	Prospective	0–5 years	147
UK, ALSPAC study (1991–1996)[60]	Longitudinal	0–5 years	889
USA, Bogulasa Heart Study[61]	Observational	0–7 years	50 (125)
Australia, Adelaide Nutrition Study[62]	Retrospective	3 months–9 years	140
France (1985–1995)[63]	Observational	10 months–8 years	112
Children diet			
UK, National diet and Nutrition survey[64,65]	Cross-sectional	1.5–4.5 years	1444
			77
USA (1994–2002)[66]	Observational	2–8 years	70
USA[67]	Longitudinal	3–6 years	146

Country, study name	*Measurements*	*Association between fat intake and measurements*
Infant diet		
Denmark (1991)[56]	Weight and weight gain	0
Denmark COPENHAGEN study (1987–1989)[32]	Weight and weight gain, skinfolds	0
Infant/children diet		
USA[57]	Weight, skinfolds, fat mass	0
USA[58]	Weight and weight gain, skinfolds, fat mass and fat mass gain	+ (weight gain) 0 (fat mass gain)
Italy (1991–1996)[59]	BMI	0
UK, ALSPAC study (1991–1996)[60]	BMI, age of adiposity rebound	0
USA, Bogulasa Heart Study[61]	Weight, skinfolds	0
Australia, Adelaide Nutrition Study[62]	Weight, skinfolds	0
France (1985–1995)[63]	BMI, skinfolds, adiposity rebound	0
Children diet		
UK, National diet and Nutrition survey[64,65]	BMI	0
	Fat mass	0
USA (1994–2002)[66]	BMI	+
USA[67]	BMI	+

LIPOPROTEIN LEVELS
AND OTHER CVD RISK FACTORS

Lipoprotein-cholesterol responses in healthy infants fed defined diets from ages 1 to 12 months: comparison of diets predominant in oleic acid versus linoleic acid, with parallel observations in infants fed a human milk-based diet[1]

J. Lipid Res. 1995. **36:** 1178–1187.

A prospective study in healthy infants predefining both diet fatty acid and cholesterol, from birth to age 1 year, compared response of cholesterol fractions in three groups: random assignment to *1)* monounsaturated-(Hi-Mono) (n = 20), or *2)* polyunsaturated-(Hi-Poly) (n = 22) fatty acid-enriched diets, or *3)* non-randomized selection to breast feeding (Human Milk) (n = 25). In each group, designated weaning foods and supplements maintained fatty acid and cholesterol intake similar to that of each group's defined formulas,

B. LDL-Cholesterol

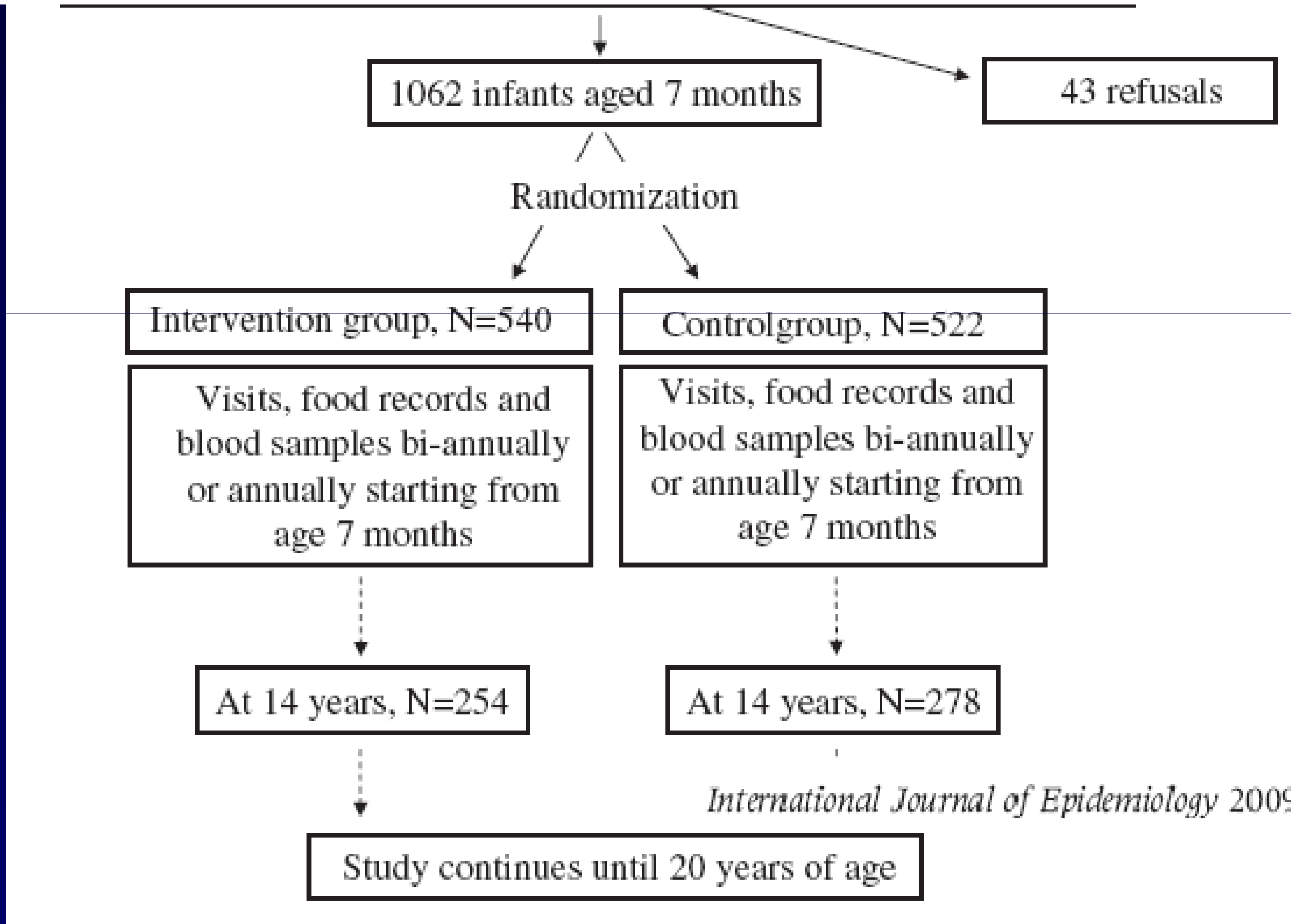
Mo	Hi-Mono	Hi-Poly	Human Milk
	mg/dL		
4	72 ± 22 (16)[f,h]	77 ± 14 (19)[g]	100 ± 34 (23)[f,g]
9	88 ± 20 (20)	84 ± 25 (18)	98 ± 24 (22)
12	98 ± 24 (16)[h,j]	79 ± 16 (16)[j]	96 ± 28 (23)

A. HDL Cholesterol

Age	Hi-Mono	Hi-Poly	Human Milk
months			
4	50 ± 12 (16)	46 ± 10 (19)	50 ± 13 (19)
9	43 ± 10 (20)	39 ± 10 (18)	45 ± 8 (22)
12	44 ± 10 (16)[a]	35 ± 8 (16)[a]	42 ± 11 (23)

Prospective randomised trial in 1062 infants of diet low in saturated fat and cholesterol

Helena Lapinleimu, Jorma Viikari, Eero Jokinen, Pia Salo, Taina Routi, Aila Leino, Tapani Rönnemaa, Ritva Seppänen, Ilkka Välimäki, Olli Simell

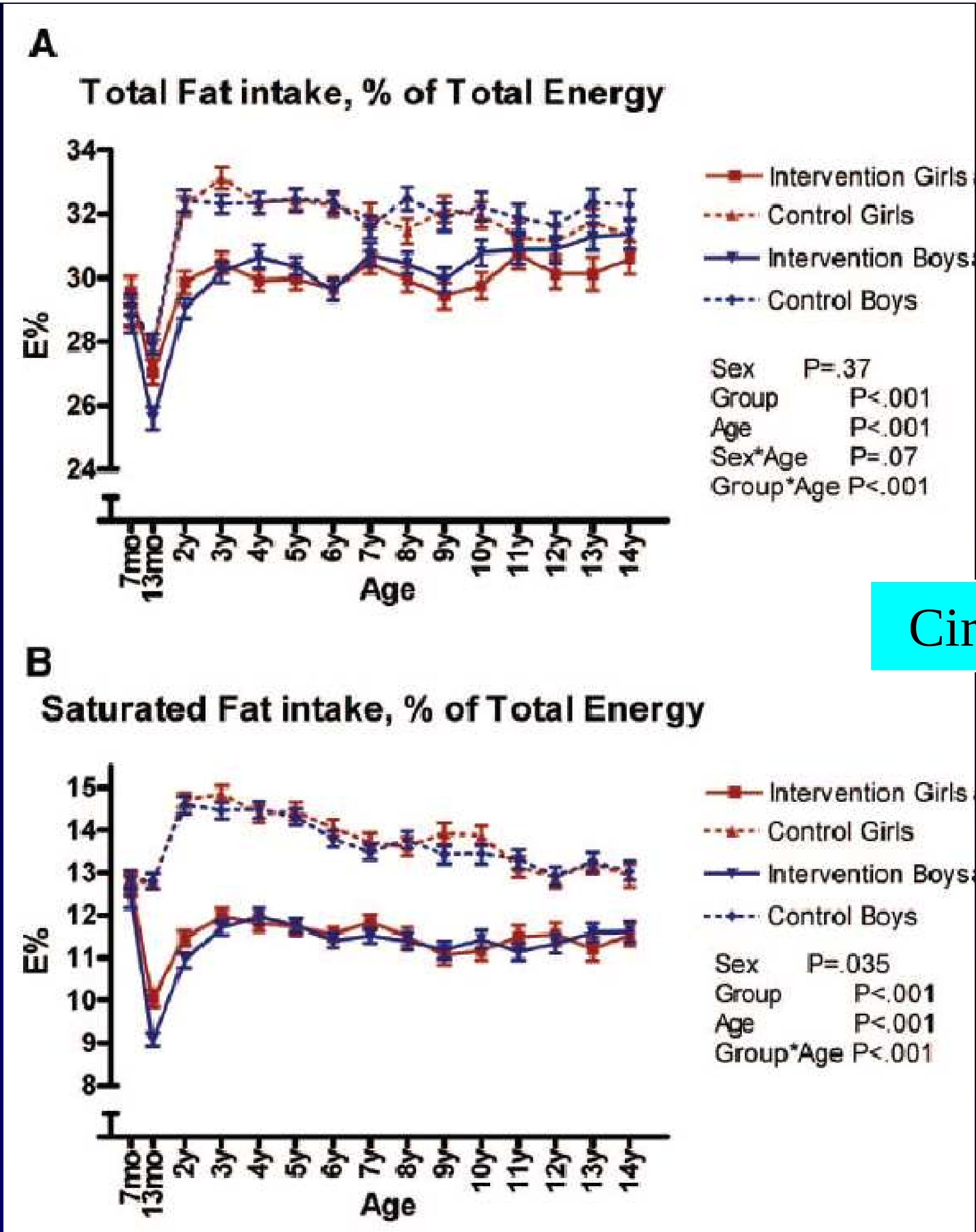


International Journal of Epidemiology 2009;**38**:650–655

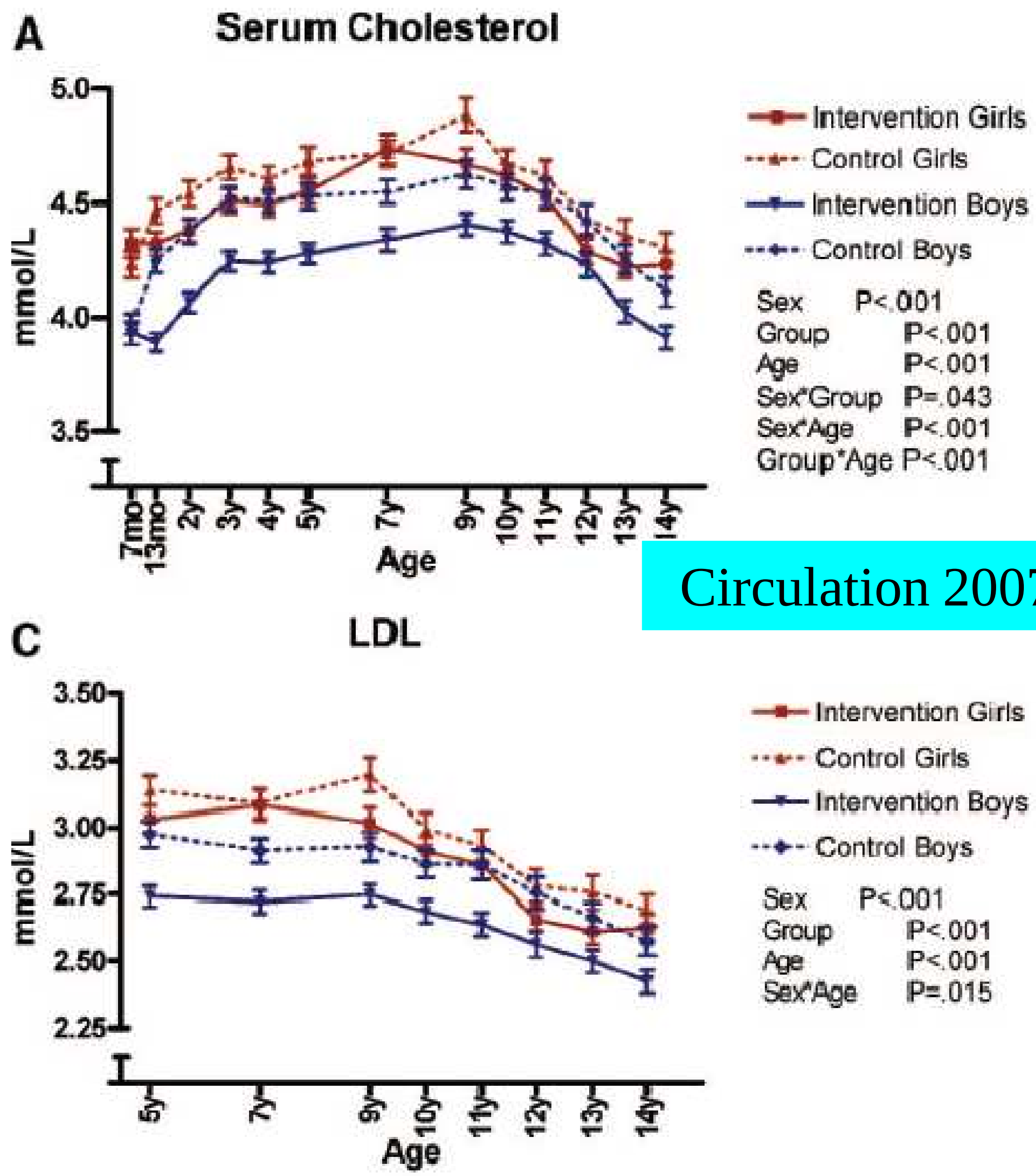
Short-term effects

- Between 7 and 13 months serum cholesterol and non-high-density-lipoprotein cholesterol concentrations increased substantially in the control group
- Growth did not differ between the groups
- Serum cholesterol concentrations fell significantly in parents of intervention-group infants.

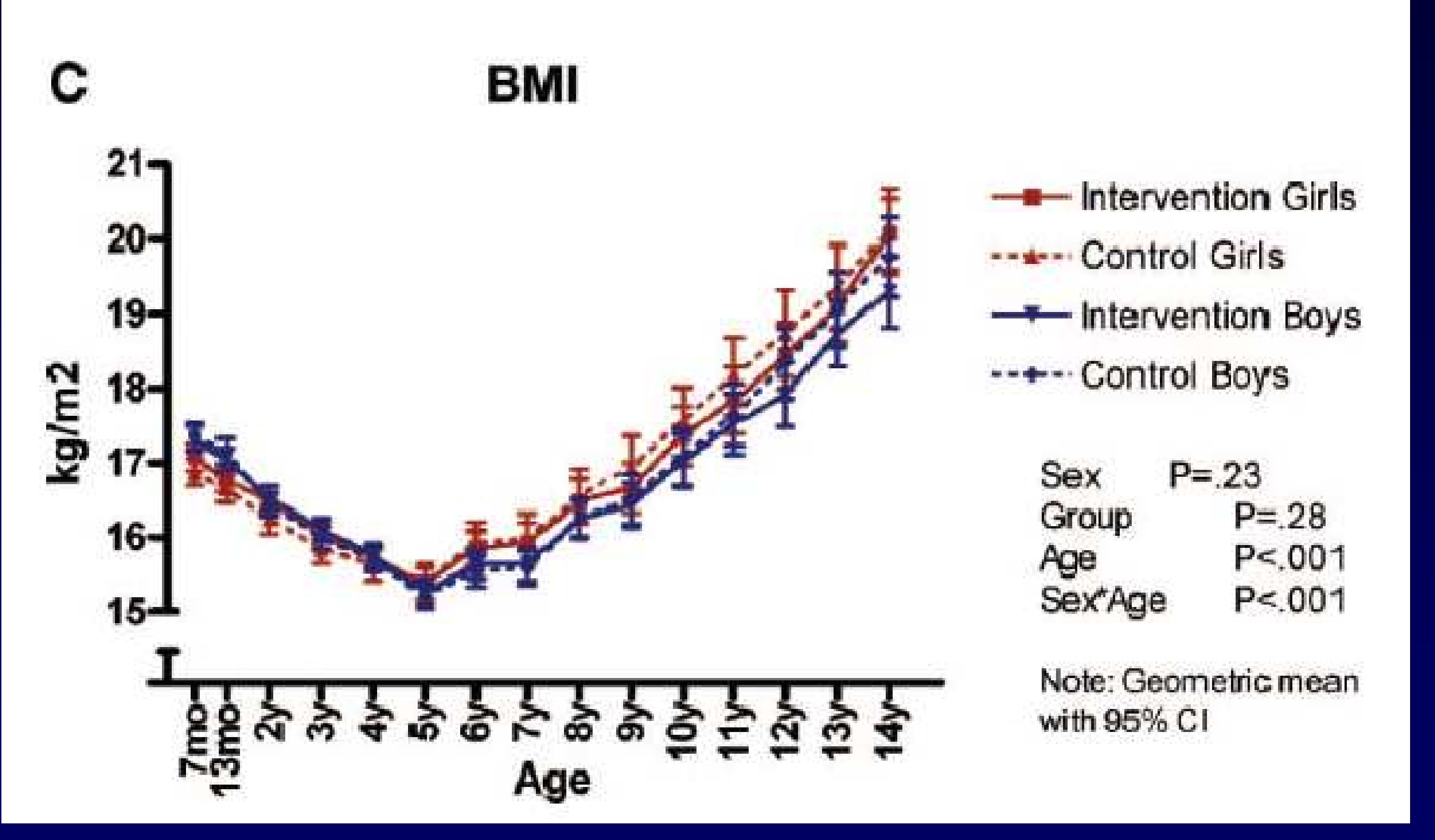
Effects on dietary habits



Circulation 2007;116:1032



Circulation 2007;116:1032



No differences in heighyt, weigh and/or BMI

Long-term effects

- At the age of 9 years, homeostasis model assessment of insulin resistance (HOMA-IR) index was lower in intervention children than in control children.
- At the age of 11 years, endothelium-dependent (flow-mediated) and endothelium-independent (nitrate-mediated) vasodilatory responses of the brachial artery were measured with high-resolution ultrasound →<u>enhanced endothelial function in intervention in boys.</u>

Diabetes Care 2006;29:781
Eur J Clin Nutr 2006;60:172

Trajectories of Growth among Children Who Have Coronary Events as Adults

N Engl J Med 2005;353:1802-9.

We studied 8760 people born in Helsinki from 1934 through 1944. Childhood growth had been recorded. A total of 357 men and 87 women had been admitted to the hospital with coronary heart disease or had died from the disease. Coronary risk factors were measured in a subset of 2003 people.

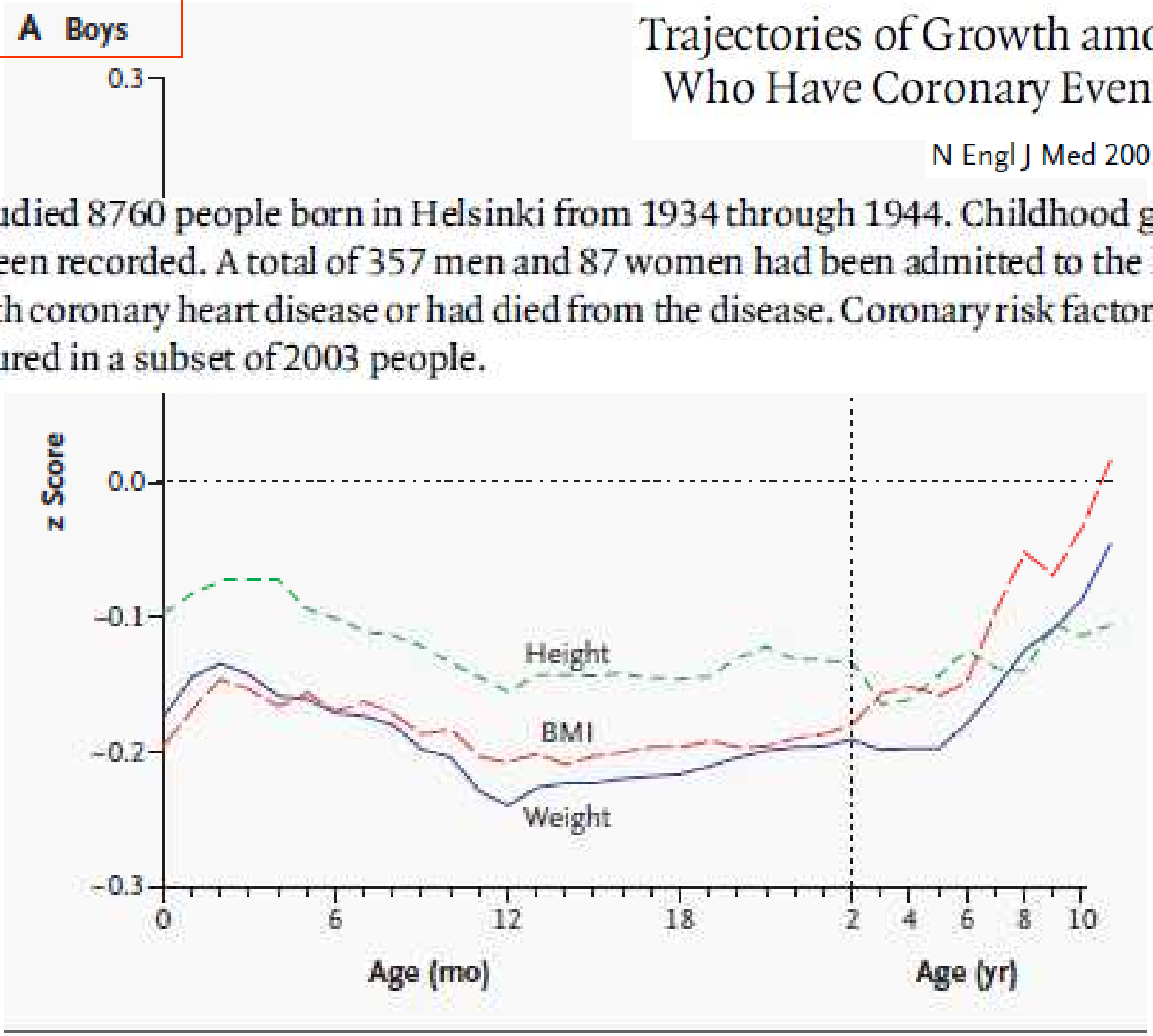


Figure 1. Mean z Scores for Height, Weight, and Body-Mass Index in the First 11 Years after Birth among Boys and Girls Who Had Coronary Heart Disease as Adults.

Trajectories of Growth among Children Who Have Coronary Events as Adults

N Engl J Med 2005;353:1802-9.

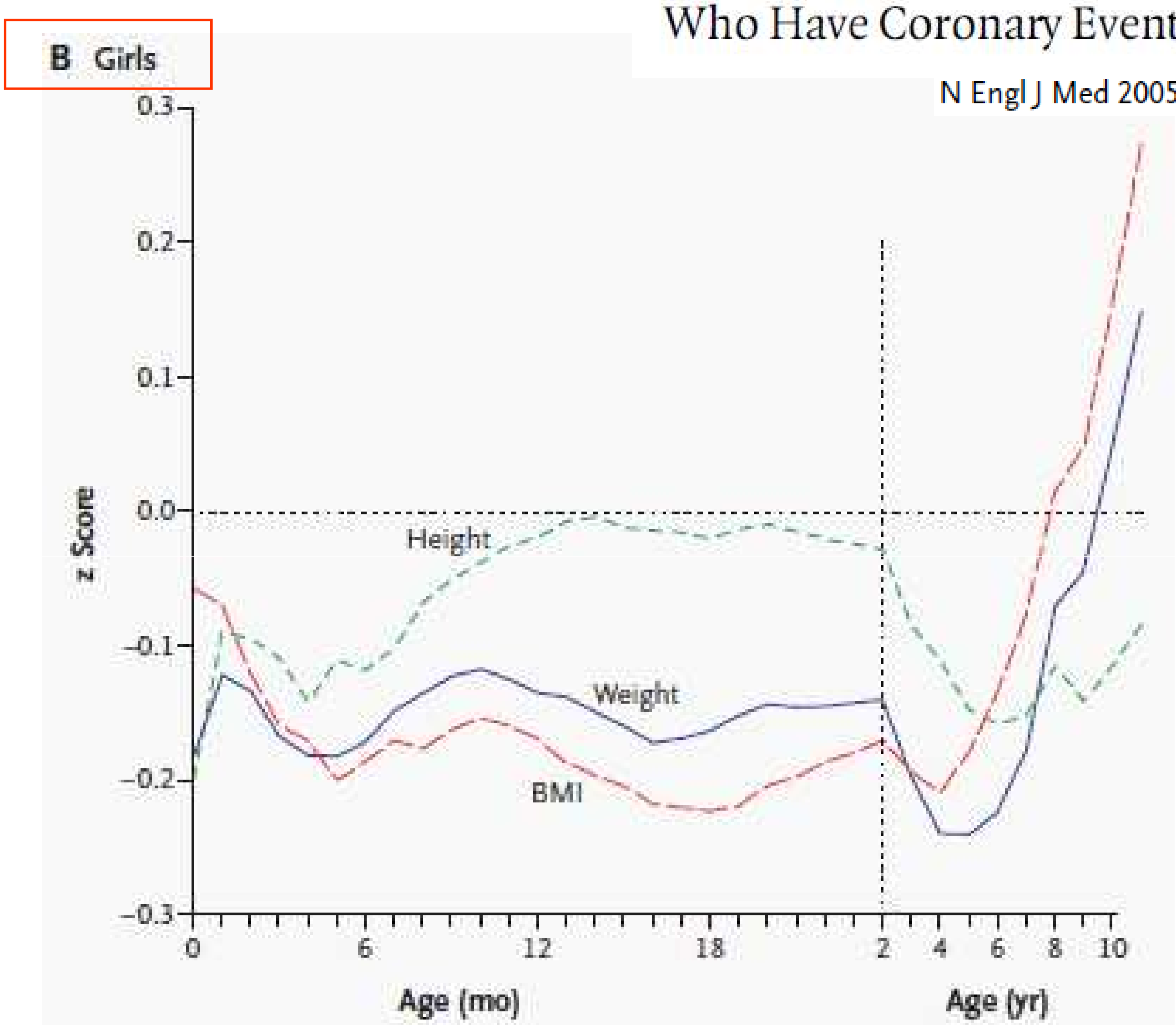
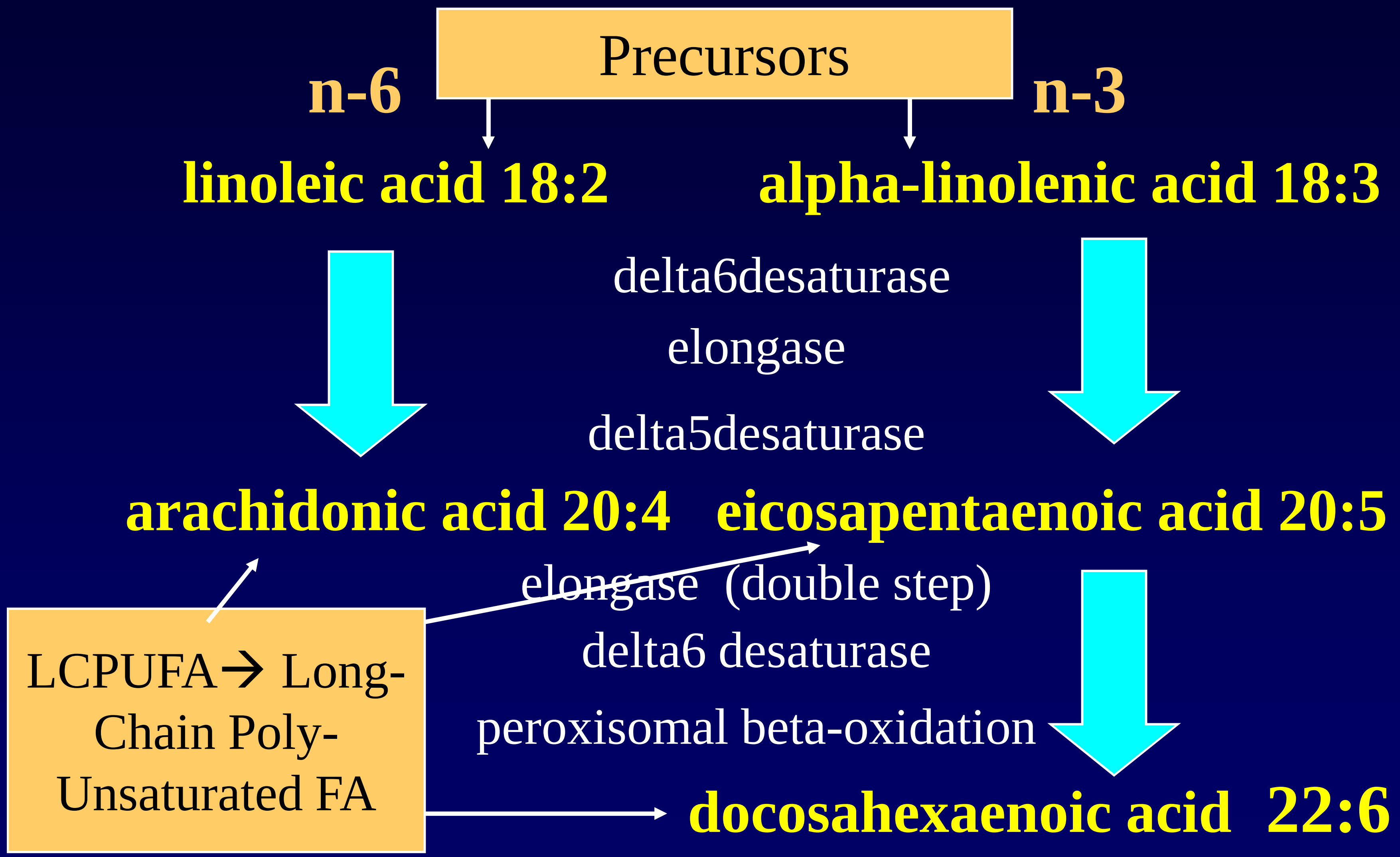


Figure 1. Mean z Scores for Height, Weight, and Body-Mass Index in the First 11 Years after Birth among Boys and Girls Who Had Coronary Heart Disease as Adults.

BRAIN DEVELOPMENT AND FUNCTION

POLYUNSATURATED FATTY ACIDS



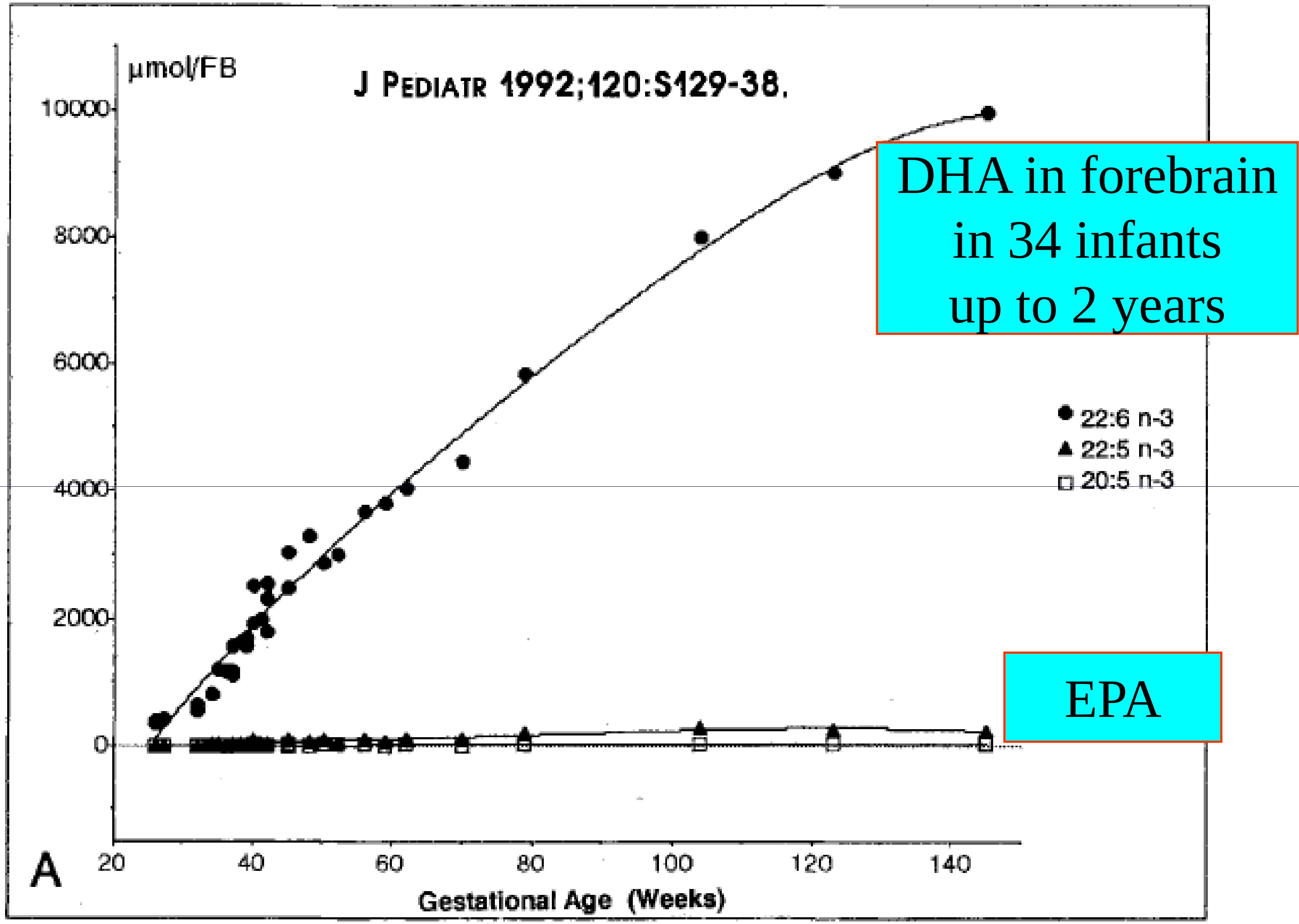


Fig. 3A. The three major n-3 brain fatty acids, DHA (22:6n-3), docosapentaenoic acid (22:5n-3), and eicosapentaenoic acid (20:5n-3), in the forebrains *(FB)* of 34 infants, including both preterm and postnatal normally fed infants up to 2 years

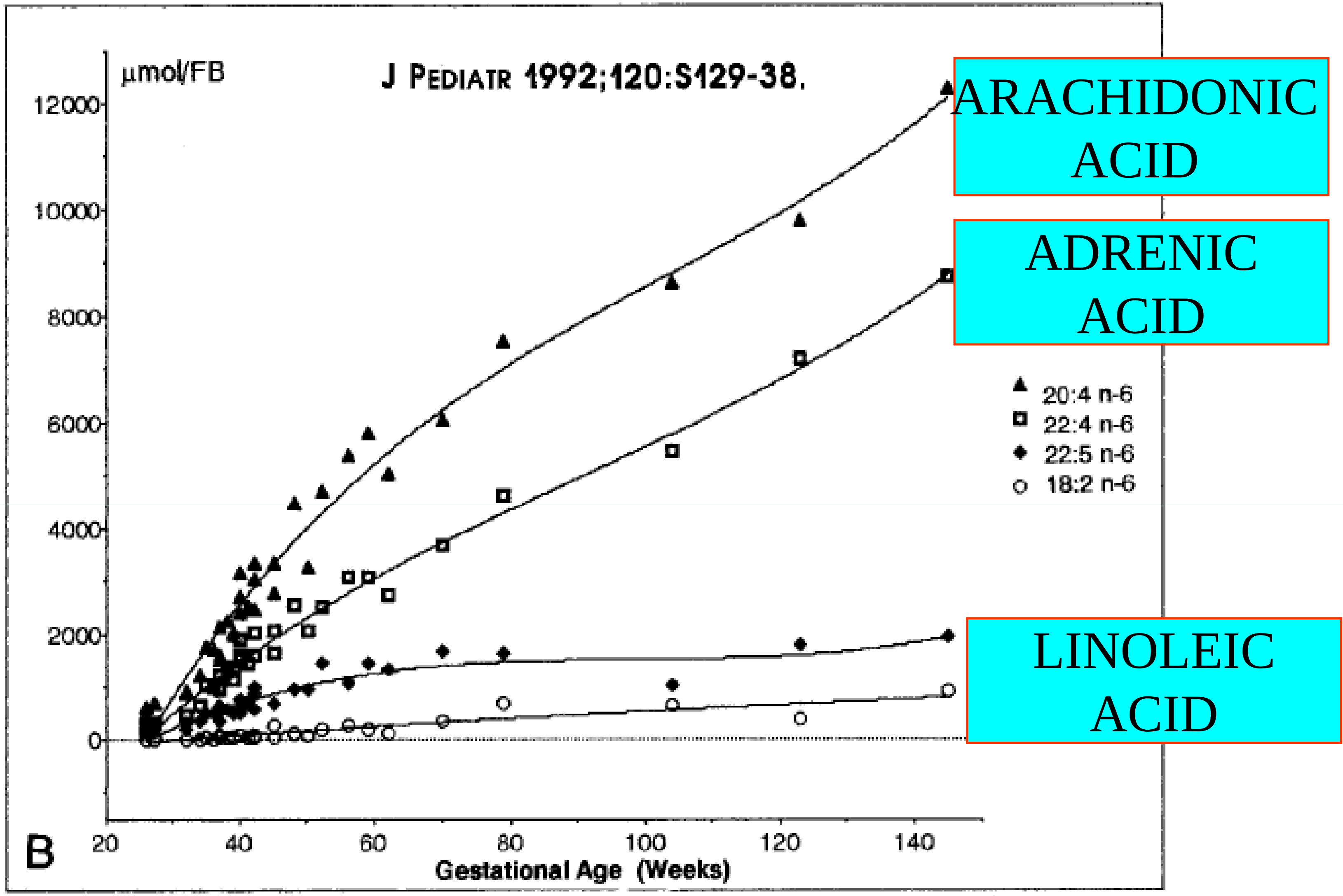


Fig. 3B. The n-6 fatty acids, AA (20:4n-6), adrenic acid (22:4n-6), 22:5n-6, and linoleic acid (18:2n-6), in the forebrains *(FB)* of 34 infants, including both preterm and postnatal normally fed infants up to 2 years of age.

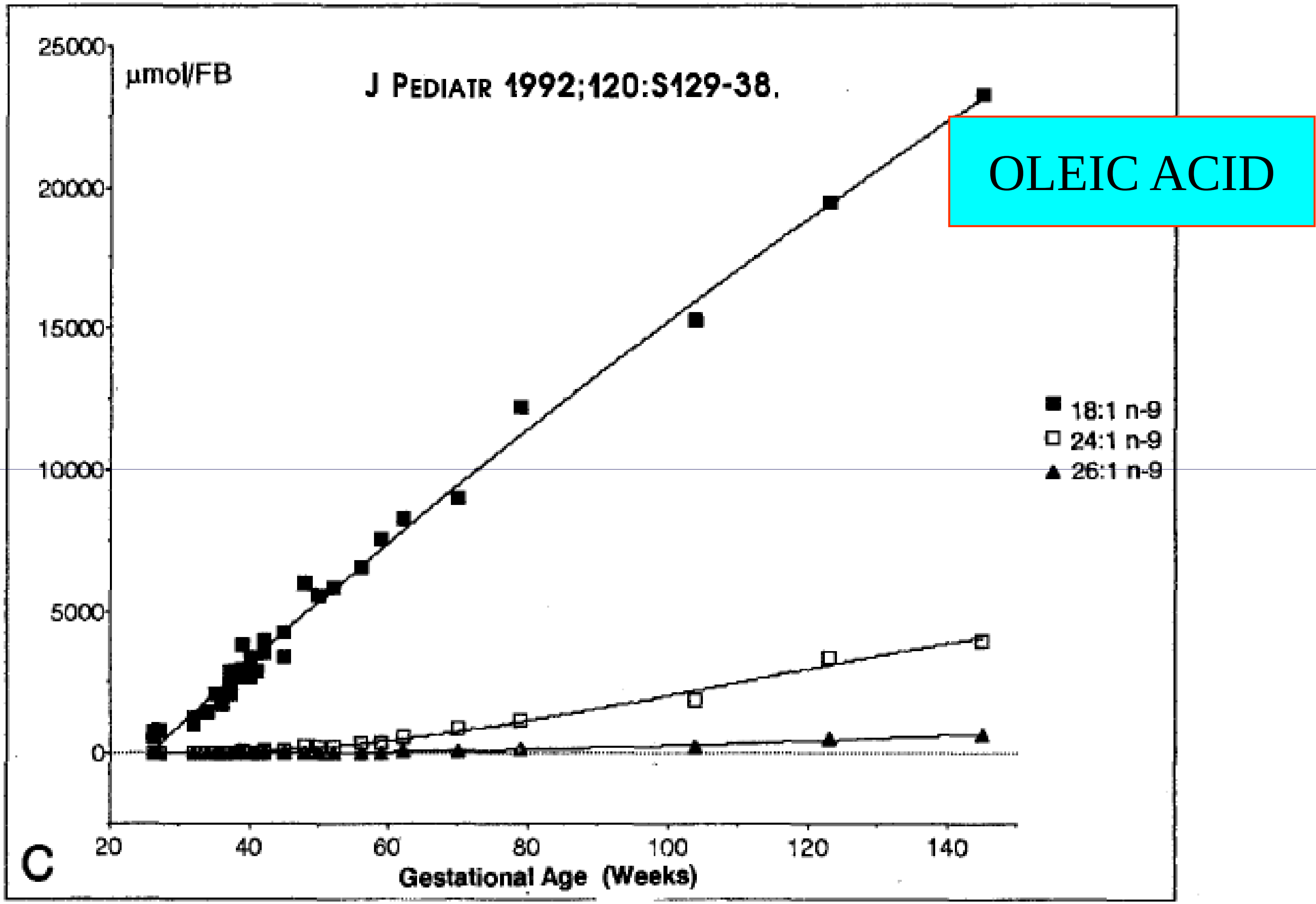


Fig. 3C. The n-9 fatty acids, 18:1n-9, 24:1n-9, and 26:1n-9, in the forebrains *(FB)* of 34 infants, The genetic background may have a relevant role…..

Moderation of breastfeeding effects on the IQ by genetic variation in fatty acid metabolism

Avshalom Caspi*[†‡], Benjamin Williams*, Julia Kim-Cohen[§], Ian W. Craig*, Barry J. Milne*, Richie Poulton[¶], Leonard C. Schalkwyk*, Alan Taylor*, Helen Werts*, and Terrie E. Moffitt*[†]

→ genes may work via the environment to shape the IQ, helping to close the nature versus nurture debate.

La valenza dei grassi nella alimentazione del bambino

- Nei primi 24 mesi la quantità di grassi nella dieta non sembra associata alo sviluppo successivo di patologia
- La qualità dei grassi può avere un ruolo rilevante
- Il ruolo dei grassi nelle epoche successive va ancora definito
- Il contributo ad un eccesso di energia, associato ad accelerazione della crescita, va controllato