Caffeine intake during pregnancy and early growth and obesity in childhood

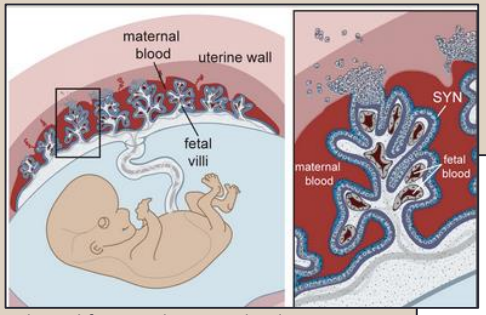
Verena Sengpiel, MD PhD

Jag har ingen jäv-/intressekonflikt att deklarera.

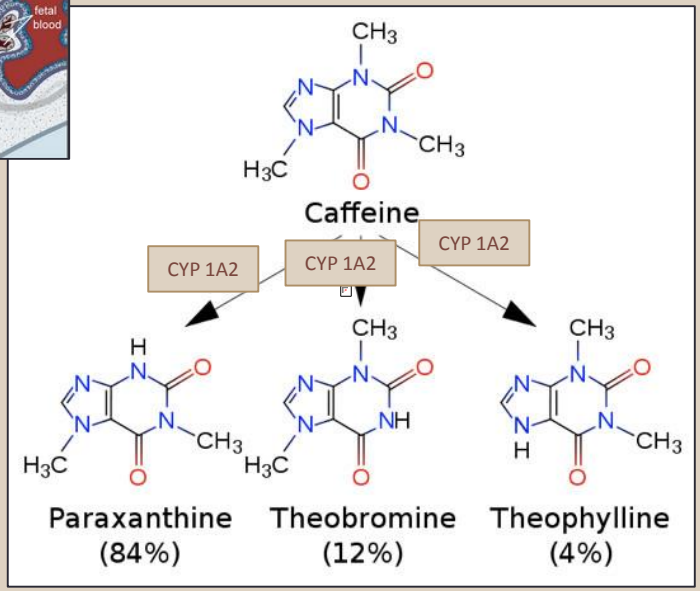
Norwegian Institute of Public Health

UNIVERSITY OF GOTHENBURG

Bakgrund



Adapted from Maltepe et al J.Clin Invest 2



Livsmedelverket:
När man är gravid bör man (…) inte få i sig mer än 300 milligram koffein per dag. Det motsvarar (…) tre koppar kaffe (…).

Bakgrund

Sengpiel et al. BMC Medicine 2013, 11:42
http://www.biomedcentral.com/1741-7015/11/42

BMC Medicine

RESEARCH ARTICLE Open Access

Maternal caffeine intake during pregnancy is associated with birth weight but not with gestational length: results from a large prospective observational cohort study

Verena Sengpiel[1*], Elisabeth Elind[2], Jonas Bacelis[1], Staffan Nilsson[3], Jakob Grove[4], Ronny Myhre[5], Margaretha Haugen[2], Helle Margrete Meltzer[2], Jan Alexander[6], Bo Jacobsson[1,5] and Anne-Lise Brantsæter[2]

Abstract

Background: Pregnant women consume caffeine daily. The aim of this study was to examine the association between maternal caffeine intake from different sources and (a) gestational length, particularly the risk for spontaneous preterm delivery (PTD), and (b) birth weight (BW) and the baby being small for gestational age (SGA).

Methods: This study is based on the Norwegian Mother and Child Cohort Study conducted by the Norwegian Institute of Public Health. A total of 59,123 women with uncomplicated pregnancies giving birth to a live singleton were identified. Caffeine intake from different sources was self-reported at gestational weeks 17, 22 and 30. Spontaneous PTD was defined as spontaneous onset of delivery between 22^{+0} and 36^{+6} weeks (n = 1,451). As there is no consensus, SGA was defined according to ultrasound-based (Marsal, n = 856), population-based (Skjaerven, n = 4,503) and customized (Gardosi, n = 4,733) growth curves.

Results: The main caffeine source was coffee, but tea and chocolate were the main sources in women with low caffeine intake. Median pre-pregnancy caffeine intake was 126 mg/day (IQR 40 to 254), 44 mg/day (13 to 104) at gestational week 17 and 62 mg/day (21 to 130) at gestational week 30. Coffee caffeine, but not caffeine from other sources, was associated with prolonged gestation (8 h/100 mg/day, $P < 10^{-7}$). Neither total nor coffee caffeine was associated with spontaneous PTD risk. Caffeine intake from different sources, measured repeatedly during pregnancy, was associated with lower BW (Marsal-28 g, Skjaerven-25 g, Gardosi-21 g per 100 mg/day additional total caffeine for a baby with expected BW 3,600 g, $P < 10^{-25}$). Caffeine intake of 200 to 300 mg/day increased the odds for SGA (OR Marsal 1.62, Skjaerven 1.44, Gardosi 1.27, $P < 0.05$), compared to 0 to 50 mg/day.

Conclusions: Coffee, but not caffeine, consumption was associated with marginally increased gestational length but not with spontaneous PTD risk. Caffeine intake was consistently associated with decreased BW and increased odds of SGA. The association was strengthened by concordant results for caffeine sources, time of survey and different SGA definitions. This might have clinical implications as even caffeine consumption below the recommended maximum (200 mg/day in the Nordic countries and USA, 300 mg/day according to the World Health Organization (WHO)) was associated with increased risk for SGA.

Keywords: preterm delivery, gestational length, small for gestational age, birth weight, growth curve, intrauterine growth restriction, caffeine, coffee, tea, soft drinks

* Correspondence: verena.sengpiel@obgyn.gu.se
[1]Department of Obstetrics and Gynaecology, Sahlgrenska Academy, Sahlgrenska University Hospital/Östra, SE-416 85 Gothenburg, Sweden
Full list of author information is available at the end of the article

Bakgrund

Sengpiel et al. BMC Medicine 2013, 11:42
http://www.biomedcentral.com/1741-7015/11/42

BMC Medicine

RESEARCH ARTICLE Open Access

Maternal caffeine intake during pregnancy is associated with birth weight but not with gestational length: results from a large prospective observational cohort study

Verena Sengpiel[1*], Elisabeth Elind[2], Jonas Bacelis[1], Staffan Nilsson[3], Jakob Grove[4], Ronny Myhre[5], Margaretha Haugen[2], Helle Margrete Meltzer[2], Jan Alexander[6], Bo Jacobsson[1,5] and Anne-Lise Brantsæter[2]

Abstract

Background: Pregnant women consume caffeine daily. The aim of this study was to examine the association between maternal caffeine intake from different sources and (a) gestational length, particularly the risk for spontaneous preterm delivery (PTD), and (b) birth weight (BW) and the baby being small for gestational age (SGA).

Methods: This study is based on the Norwegian Mother and Child Cohort Study conducted by the Norwegian Institute of Public Health. A total of 59,123 women with uncomplicated pregnancies giving birth to a live singleton were identified. Caffeine intake from different sources was self-reported at gestational weeks 17, 22 and 30. Spontaneous PTD was defined as spontaneous onset of delivery between 22^{+0} and 36^{+6} weeks (n = 1,451). As there is no consensus, SGA was defined according to ultrasound-based (Marsal, n = 856), population-based (Skjaerven, n = 4,503) and customized (Gardosi, n = 4,733) growth curves.

Results: The main caffeine source was coffee, but tea and chocolate were the main sources in women with low caffeine intake. Median pre-pregnancy caffeine intake was 126 mg/day (IQR 40 to 254), 44 mg/day (13 to 104) at gestational week 17 and 62 mg/day (21 to 130) at gestational week 30. Coffee caffeine, but not caffeine from other sources, was associated with prolonged gestation (8 h/100 mg/day, $P < 10^{-7}$). Neither total nor coffee caffeine was associated with spontaneous PTD risk. Caffeine intake from different sources, measured repeatedly during pregnancy, was associated with lower BW (Marsal-28 g, Skjaerven-25 g, Gardosi-21 g per 100 mg/day additional total caffeine for a baby with expected BW 3,600 g, $P < 10^{-25}$). Caffeine intake of 200 to 300 mg/day increased the odds for SGA (OR Marsal 1.62, Skjaerven 1.44, Gardosi 1.27, $P < 0.05$), compared to 0 to 50 mg/day.

Conclusions: Coffee, but not caffeine, consumption was associated with marginally increased gestational length but not with spontaneous PTD risk. Caffeine intake was consistently associated with decreased BW and increased odds of SGA. The association was strengthened by concordant results for caffeine sources, time of survey and different SGA definitions. This might have clinical implications as even caffeine consumption below the recommended maximum (200 mg/day in the Nordic countries and USA, 300 mg/day according to the World Health Organization (WHO)) was associated with increased risk for SGA.

Keywords: preterm delivery, gestational length, small for gestational age, birth weight, growth curve, intrauterine growth restriction, caffeine, coffee, tea, soft drinks

* Correspondence: verena.sengpiel@obgyn.gu.se
[1]Department of Obstetrics and Gynaecology, Sahlgrenska Academy, Sahlgrenska University Hospital/Östra, SE-416 85 Gothenburg, Sweden
Full list of author information is available at the end of the article

Neither total nor coffee caffeine was associated with spontaneous PTD risk.

Bakgrund

Sengpiel et al. BMC Medicine 2013, 11:42
http://www.biomedcentral.com/1741-7015/11/42

BMC Medicine

RESEARCH ARTICLE Open Access

Maternal caffeine intake during pregnancy is associated with birth weight but not with gestational length: results from a large prospective observational cohort study

Verena Sengpiel[1*], Elisabeth Elind[2], Jonas Bacelis[1], Staffan Nilsson[3], Jakob Grove[4], Ronny Myhre[5], Margaretha Haugen[2], Helle Margrete Meltzer[2], Jan Alexander[6], Bo Jacobsson[1,5] and Anne-Lise Brantsæter[2]

Abstract

Background: Pregnant women consume caffeine daily. The aim of this study was to examine the association between maternal caffeine intake from different sources and (a) gestational length, particularly the risk for spontaneous preterm delivery (PTD), and (b) birth weight (BW) and the baby being small for gestational age (SGA).

Methods: This study is based on the Norwegian Mother and Child Cohort Study conducted by the Norwegian Institute of Public Health. A total of 59,123 women with uncomplicated pregnancies giving birth to a live singleton were identified. Caffeine intake from different sources was self-reported at gestational weeks 17, 22 and 30. Spontaneous PTD was defined as spontaneous onset of delivery between 22^{+0} and 36^{+6} weeks (n = 1,451). As there is no consensus, SGA was defined according to ultrasound-based (Marsal, n = 856), population-based (Skjaerven, n = 4,503) and customized (Gardosi, n = 4,733) growth curves.

Results: The main caffeine source was coffee, but tea and chocolate were the main sources in women with low caffeine intake. Median pre-pregnancy caffeine intake was 126 mg/day (IQR 40 to 254), 44 mg/day (13 to 104) at gestational week 17 and 62 mg/day (21 to 130) at gestational week 30. Coffee caffeine, but not caffeine from other sources, was associated with prolonged gestation (8 h/100 mg/day, $P < 10^{-7}$). Neither total nor coffee caffeine was associated with spontaneous PTD risk. Caffeine intake from different sources, measured repeatedly during pregnancy, was associated with lower BW (Marsal-28 g, Skjaerven-25 g, Gardosi-21 g per 100 mg/day additional total caffeine for a baby with expected BW 3,600 g, $P < 10^{-25}$). Caffeine intake of 200 to 300 mg/day increased the odds for SGA (OR Marsal 1.62, Skjaerven 1.44, Gardosi 1.27, $P < 0.05$), compared to 0 to 50 mg/day.

Conclusions: Coffee, but not caffeine, consumption was associated with marginally increased gestational length but not with spontaneous PTD risk. Caffeine intake was consistently associated with decreased BW and increased odds of SGA. The association was strengthened by concordant results for caffeine sources, time of survey and different SGA definitions. This might have clinical implications as even caffeine consumption below the recommended maximum (200 mg/day in the Nordic countries and USA, 300 mg/day according to the World Health Organization (WHO)) was associated with increased risk for SGA.

Keywords: preterm delivery, gestational length, small for gestational age, birth weight, growth curve, intrauterine growth restriction, caffeine, coffee, tea, soft drinks

* Correspondence: verena.sengpiel@obgyn.gu.se
[1]Department of Obstetrics and Gynaecology, Sahlgrenska Academy, Sahlgrenska University Hospital/Östra, SE-416 85 Gothenburg, Sweden
Full list of author information is available at the end of the article

Neither total nor coffee caffeine was associated with spontaneous PTD risk.

Caffeine intake from different sources (…) was associated with lower birthweight. Caffeine intake of 200 to 300 mg/day increased the odds for SGA (OR Marsal 1.62, Skjaerven 1.44, Gardosi 1.27, P <0.05), compared to 0 to 50 mg/day.

Frågeställning

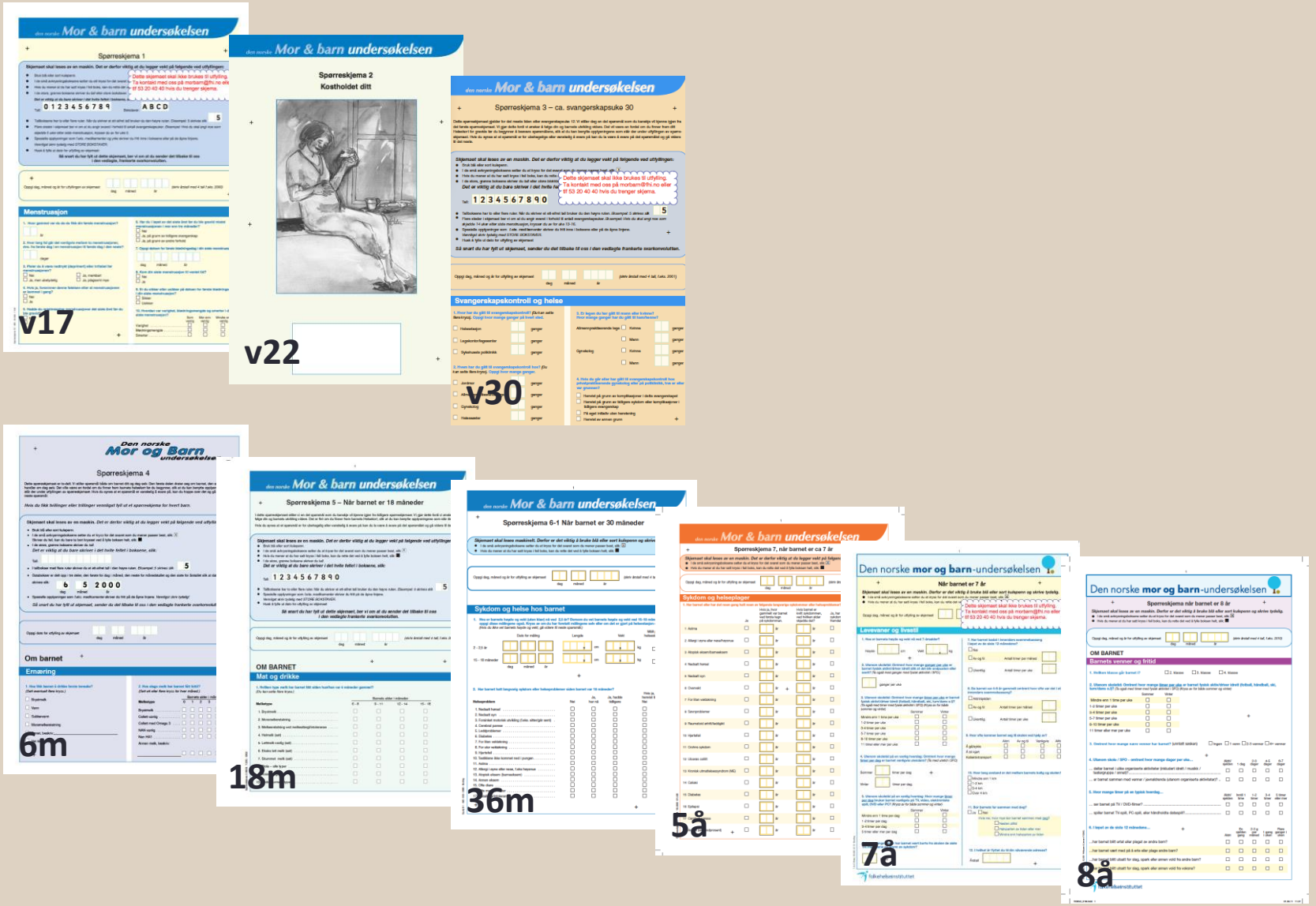
Är mammans koffeinintag under graviditeten relaterat till:

1. barnets tillväxt?

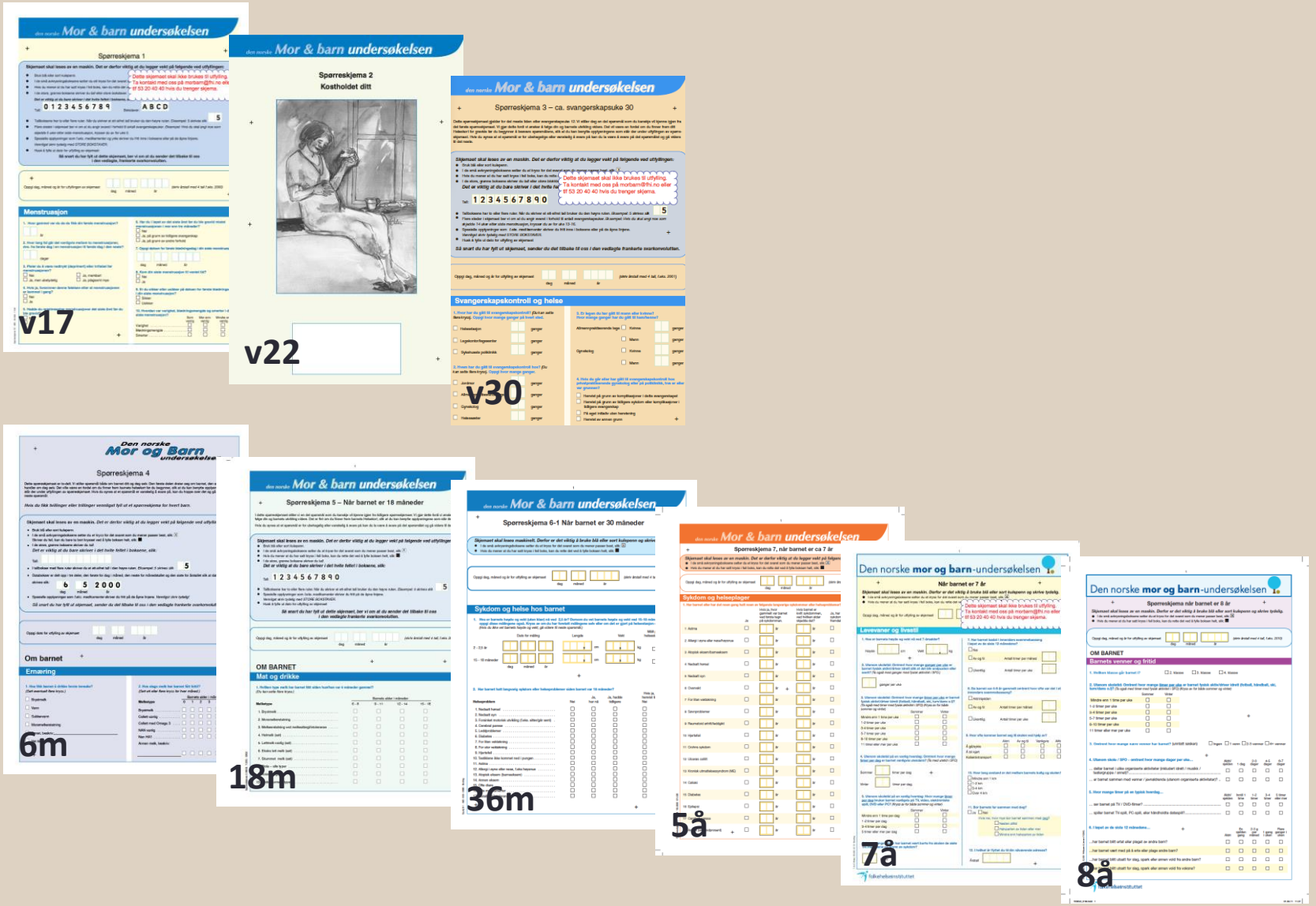
2. barnets risk för övervikt?

Material & Metoder

Norwegian **Mother and Child** Cohort Study



http://www.fhi.no/studier/den-norske-mor-og-barn-undersokelsen



Mammorna har rapporterat barnets vikt samt längd/höjd för åldrarna:
6 veckor, 3, 5-6, 8 och 15-18 månader samt 2, 3, 5, 7 och 8 års åldern

Studiepopulation

- Fullgångna enkelbörd
- Inga missbildningar
- Koffein- , graviditets- och tillväxtdata

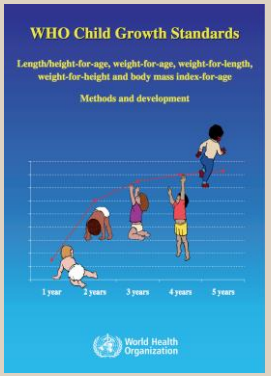
Food frequency questionnaire

Coffee/tea		How many cups/mugs per day 8+	6-7	4-5	2-3	1	or per week 5-6	3-4	1-2	or per month 2-3	1	0
30. Filter coffee	(1 cup)			BB265				BB266			BB267	
31. Coffee instant	(1 cup)			BB268				BB269			BB270	
32. Coffee boiled/press	(1 cup)			BB271				BB272			BB273	
33. Cafe latte, cappuccino	(1 cup)			BB274				BB275			BB276	
34. Espresso	(1 cup)			BB277				BB278			BB279	
35. Decaffeinated coffee	(1 cup)			BB280				BB281			BB282	
36. Fig/barley coffee	(1 cup)			BB283				BB284			BB285	
37. Tea (ordinary, Lipton fruit tea etc.)	(1 mug)			BB286				BB287			BB288	
38. Green tea	(1 mug)			BB289				BB290			BB291	
39. Rosehip tea, herb tea	(1 mug)			BB292				BB293			BB294	

Koffein i olika näringsämnen

Food item	caffeine (mg)/100 g of food item
Coffee, filtered and percolated/pressed	57
Powdered instant coffee	40
Espresso	114
Cappuccino and caffè latte	21
Decaffeinated coffee	2
Caffeinated soft drinks, sugar-sweetened and artificially sweetened [1]	12
Energy drinks	15[2]
Black tea	16
Chocolate milk	2
Sandwich spread containing cocoa	13
Dessert containing cocoa	3
Cake containing cocoa	4
Chocolate, medium-dark	38
Milk chocolate	15
Sweets containing cocoa	9

Utfall: tillväxt & övervikt



Tillväxtkurvor baserat på WHO's:
"Multicenter Growth Reference Study"
(www.who.int/childgrowth)

- Weight-for-age z-scores

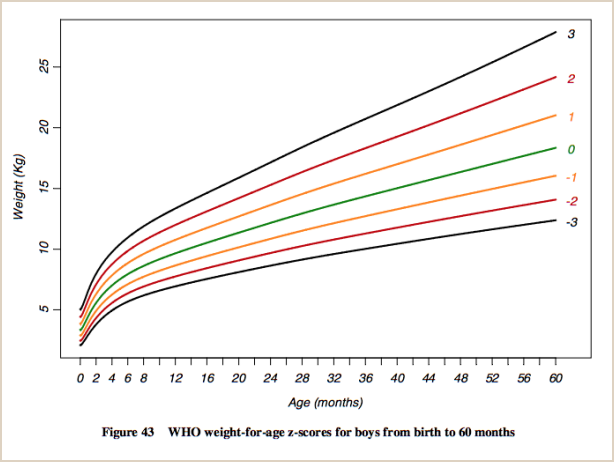


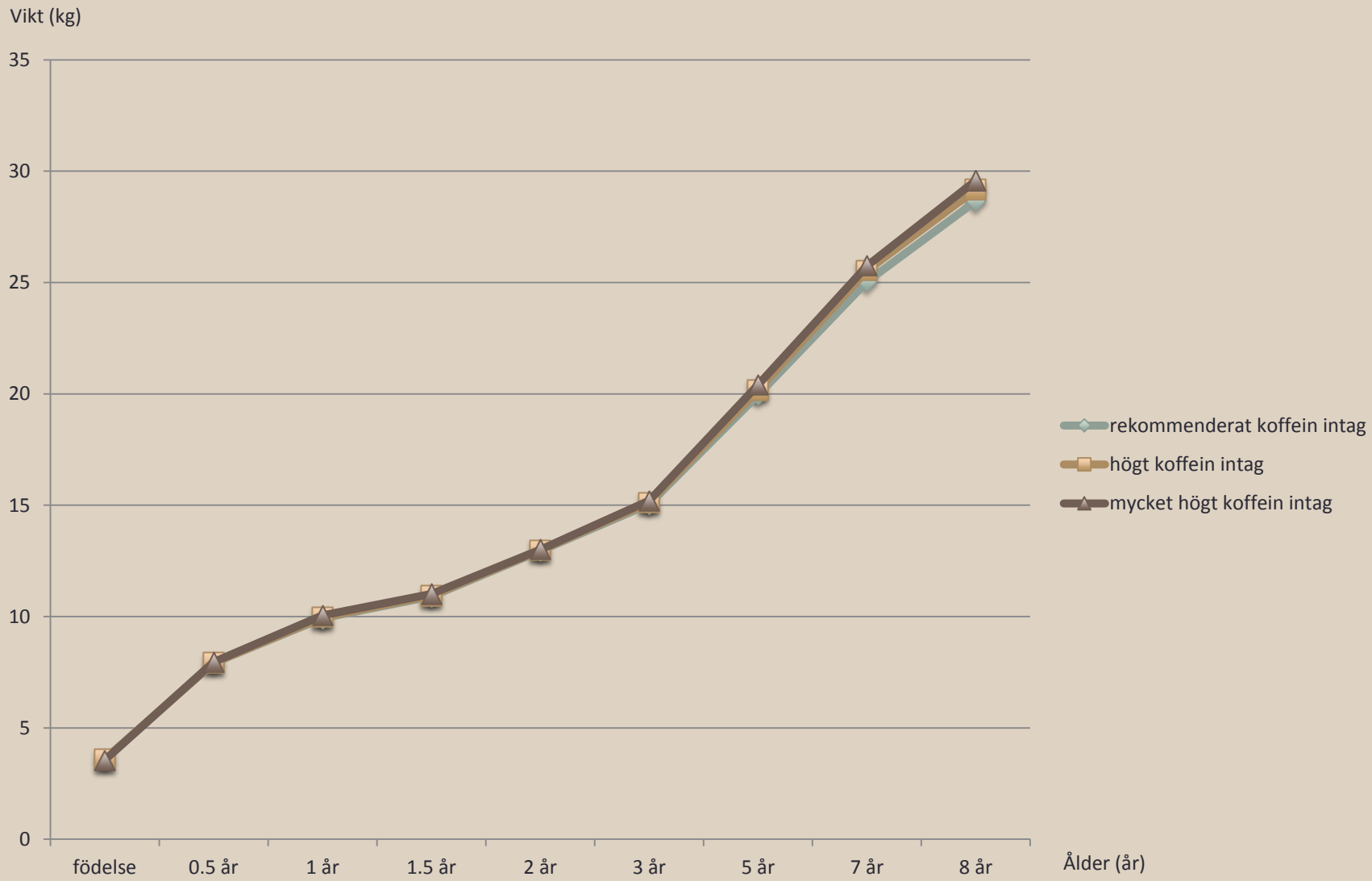
Figure 43 WHO weight-for-age z-scores for boys from birth to 60 months

- "catch-up growth":
  ökning av weight-for-age z-score >0.67
- övervikt: BMI >85e percentil

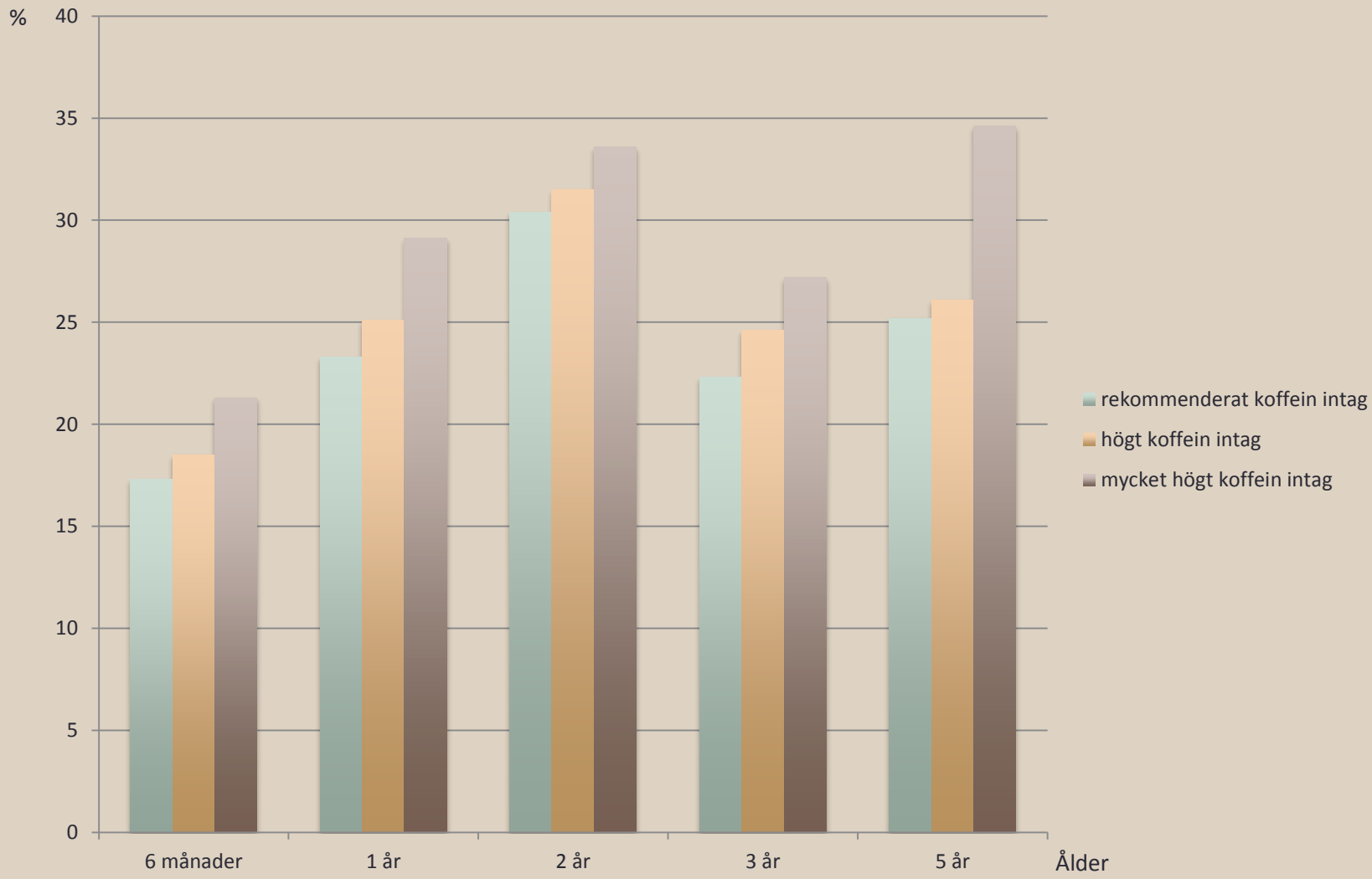
Resultat: studiepopulationen

	Rekommenderat koffein intag (<200 mg/d)	Högt koffein intag (200-300 mg/d)	Mycket högt koffein intag (>300 mg/d)
Antal kvinnor (total n= 83 705)	74 587	6 287	2 831
Mammans ålder (år)			
<25	11	6	7
25-29	34	25	22
30-34	39	42	39
≥35	16	27	31
Familjeinkomst			
Båda partner lågt	26	24	33
En partner hög	41	41	42
Båda partner hög	30	33	21
Data saknas	3	3	4
Mammans utbildning (år)			
≤12	29	31	48
13-16	42	40	35
≥17	26	27	15
data saknas	2	2	2
BMI (kg/m^2)			
<18.5	3	3	3
18.5-24.9	64	64	58
25-29.9	21	21	24
≥30	9	9	12
data saknas	3	3	4
Graviditetsillamående 2a trim			
Ja	89	92	90
Nej	12	8	10
SGA (Marsal) 1 593 (1.9%)	1.8	2.0	3.0

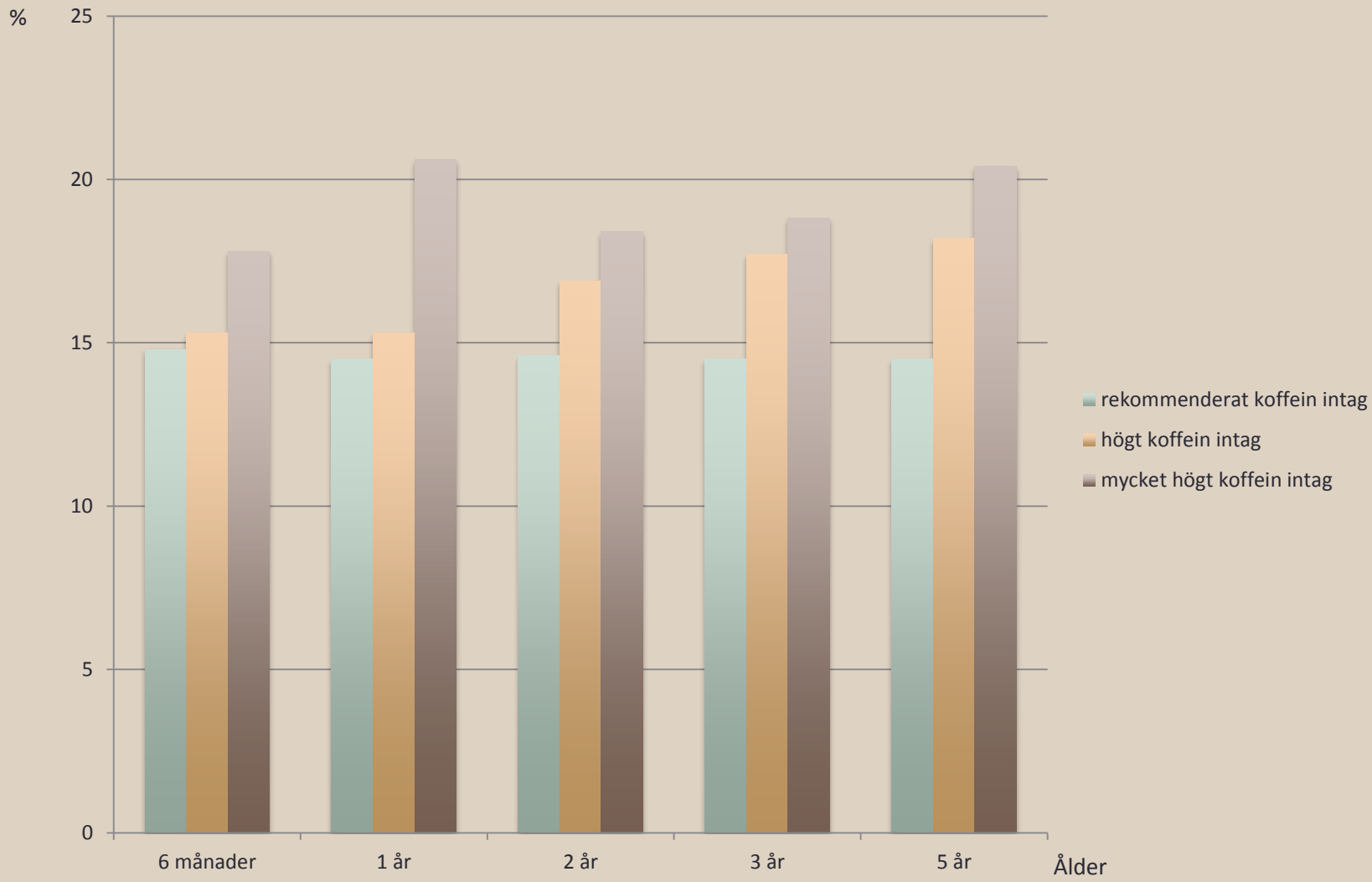
Utfall: barnens tillväxt



Utfall: catch-up growth



Utfall: övervikt



Resultat

	Catch-up tillväxt		Övervikt	
	OR	**95% CI**	**OR**	**95% CI**
6 månader				
rekommenderat koffein intag	1.00		1.00	
högt koffein intag	1.18	1.07-1.30	1.01	0.91-1.11
mycket högt koffein intag	1.24	1.08-1.44	1.14	0.99-1.32
1 år				
rekommenderat koffein intag	1.00		1.00	
högt koffein intag	1.18	1.08-1.29	1.04	0.94-1.15
mycket högt koffein intag	1.34	1.17-1.52	1.33	1.16-1.54
2 år				
rekommenderat koffein intag	1.00		1.00	
högt koffein intag	1.16	1.03-1.30	1.17	1.01-1.34
mycket högt koffein intag	1.27	1.07-1.51	1.26	1.02-1.55
3 år				
rekommenderat koffein intag	1.00		1.00	
högt koffein intag	1.25	1.13-1.38	1.25	1.12-1.40
mycket högt koffein intag	1.31	1.12-1.53	1.26	1.06-1.50
5 år				
rekommenderat koffein intag	1.00		1.00	
högt koffein intag	1.17	1.04-1.32	1.31	1.15-1.51
mycket högt koffein intag	1.48	1.23-1.78	1.47	1.19-1.81

Styrkor & Svagheter

- Stor studiepopulation
- Exponering-utfall validitet i MoBa
- Prospektiv datainsamling
- Koffein från olika källor
- Validerat frågeformulär
- Justering för många confounders

- Högutbildade överrepresenterat

- Inga biologiska markörer
- Ingen RCT: okänd confounding
- Inga data om genetisk uppsättning

Konklusion

- Koffeinintag under graviditeten är relaterat till tillväxten under barndomen.

- Koffeinintag under graviditeten är relaterat till övervikt i förskoleåldern.

Tack till alla medförfattarna:

Norwegian Institute of Public Health, Department of Exposure and Risk Assessment, Division of Environmental Medicine, Oslo, Norway: Eleni Papadopoulou, Anne Lise Brantsæter, Margaretha Haugen, Helle Margrete Meltzer

Department of Obstetrics and Gynecology, Sahlgrenska Academy, Sahlgrenska University Hospital, Gothenburg, Sweden: Bo Jacobsson, Jonas Bacelis

Department of Pediatrics, Sahlgrenska Academy, Sahlgrenska University Hospital, Gothenburg, Sweden: Anders Elfvin

Tack för uppmärksamheten!

Frågor?





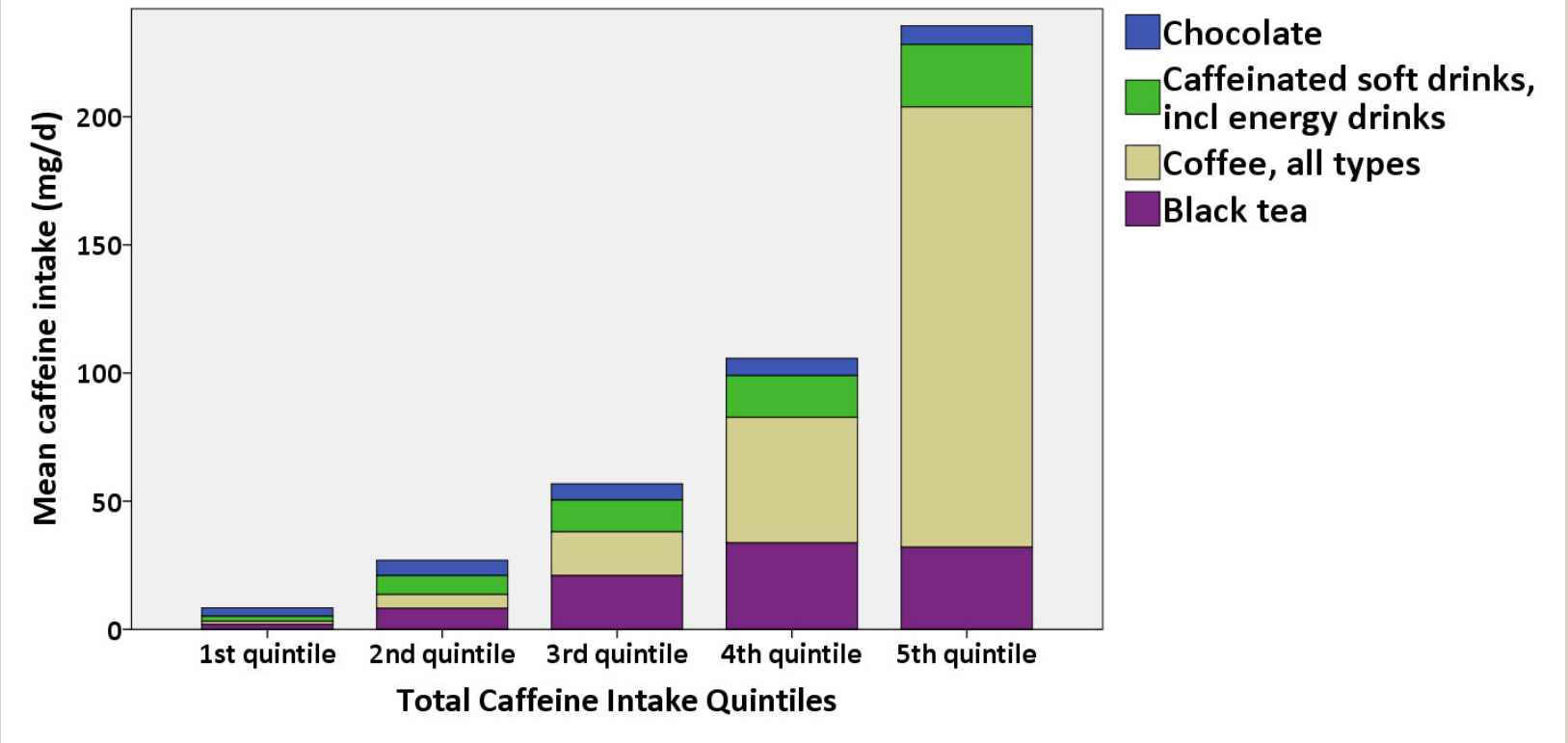







Google bilder sökning “Verena Sengpiel” 140228

Koffeinkällor beroende på mängden total koffein



Koffeinintag vid olika tidpunkter

Table 8 Birth weight and maternal caffeine intake at different timepoints before and during pregnancy

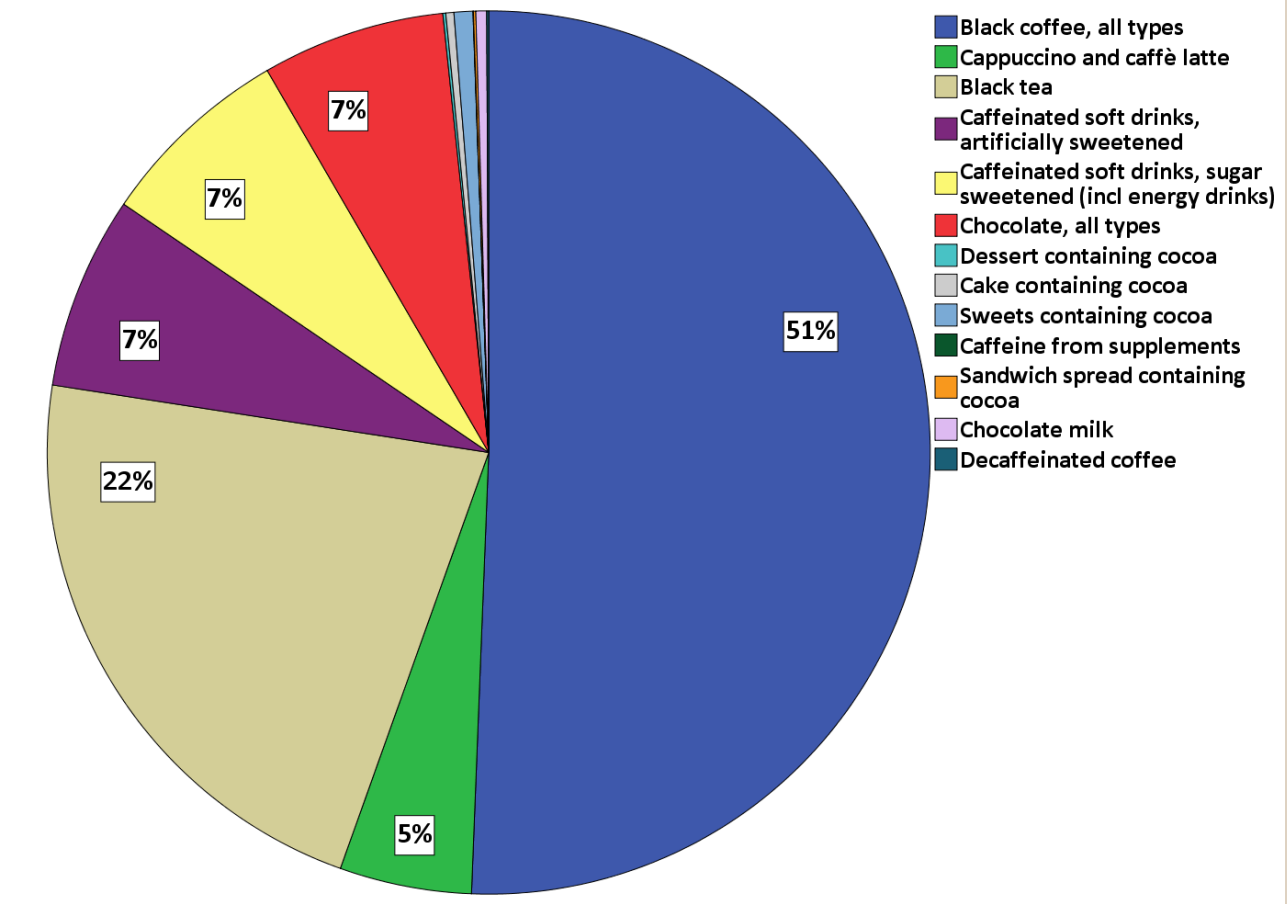
Model[a]	Caffeine source	Birth weight (Marsal)			Birth weight (Skjaerven)			Birth weight (Gardosi)		
		β (g)	95% CI	*P* value	β (g)	95% CI	*P* value	β (g)	95% CI	*P* value
Pre-pregnancy:										
I	Total	-3	-5 to-2	$<10^{-6}$	-2	-4 to-1	$<10^{-3}$	-1	-3 to 0	0.04
	Coffee, all types	-3	-4 to-2	$<10^{-4}$	-2	-3 to 0	0.02	-1	-3 to 0	0.07
	Caffeinated soft drinks[b]	-3	-7 to 1	0.1	-4	-8 to 0	0.06	-1	-5 to 3	0.6
	Black tea	-16	-23 to-9	$<10^{-5}$	-16	-23 to-8	$<10^{-4}$	-6	-13 to 1	0.1
II	Total	1	-1 to 3	0.3	2	0 to 3	0.03	2	1 to 4	0.003
	Coffee, all types	1	-1 to 3	0.2	2	0 to 4	0.02	3	1 to 4	$<3 \times 10^{-3}$
	Caffeinated soft drinks[b]	4	-3 to 10	0.3	3	-3 to 10	0.3	5	-1 to 11	0.1
	Black tea	-12	-21 to-2	0.02	-13	-22 to-3	0.01	-3	-12 to 7	0.6
17th week of gestation:										
I	Total	-9	-12 to-7	$<10^{-17}$	-8	-10 to-6	$<10^{-13}$	-7	-9 to-5	$<10^{-10}$
	Coffee, all types	-9	-11 to-6	$<10^{-11}$	-7	-10 to-5	$<10^{-7}$	-7	-10 to-5	$<10^{-8}$
	Caffeinated soft drinks[b]	-9	-15 to-4	$<2 \times 10^{-3}$	-10	-15 to-4	$<10^{-3}$	-6	-11 to-1	0.03
	Black tea	-14	-22 to-6	$<10^{-3}$	-12	-20 to-4	$<5 \times 10^{-3}$	-6	-14 to 2	0.13
II	Total	-8	-11 to-6	$<10^{-8}$	-8	-10 to-5	$<10^{-8}$	-7	-10 to-5	$<10^{-8}$
	Coffee, all types	-8	-11 to-4	$<10^{-5}$	-8	-11 to-4	$<10^{-5}$	-7	-10 to-4	$<10^{-4}$
	Caffeinated soft drinks[b]	-13	-22 to-5	$<3 \times 10^{-3}$	-13	-22 to-4	$<4 \times 10^{-3}$	-12	-20 to-3	$<7 \times 10^{-3}$
	Black tea	-1	-12 to 9	0.8	2	-9 to 13	0.8	-3	-14 to 7	0.5
30th week of gestation:										
I	Total	-8	-10 to-6	$<10^{-13}$	-7	-9 to-5	$<10^{-10}$	-6	-8 to-4	$<10^{-7}$
	Coffee, all types	-9	-11 to-6	$<10^{-10}$	-7	-9 to-4	$<10^{-7}$	-7	-10 to-5	$<10^{-8}$
	Caffeinated soft drinks[b]	-2	-6 to 3	0.5	-3	-7 to 2	0.3	0	-5 to 4	0.9
	Black tea	-18	-27 to-10	$<10^{-4}$	-18	-27 to-9	$<10^{-4}$	-8	-16 to 1	0.08
II	Total	-5	-7 to-3	$<10^{-4}$	-5	-7 to-3	$<10^{-4}$	-4	-7 to-2	$<10^{-3}$
	Coffee, all types	-6	-9 to-3	$<10^{-3}$	-5	-9 to-2	$<2 \times 10^{-3}$	-6	-9 to-3	$<10^{-4}$
	Caffeinated soft drinks[b]	-1	-6 to 5	0.8	-1	-6 to 4	0.7	0	-5 to 5	0.9
	Black tea	-14	-24 to-4	$<5 \times 10^{-3}$	-15	-25 to-5	$<3 \times 10^{-3}$	-6	-16 to 3	0.2

Birth weight (BW) and maternal caffeine intake reported at different timepoints before and during pregnancy (data from Q1 and Q3), linear regression for three caffeine sources as well as total caffeine intake, n = 59,123 in the Norwegian Mother and Child Cohort Study, 2002 to 2009. β = BW gain (in g) per 100 mg additional caffeine/day for a baby with an expected BW of 3,600 g.

[a]*P* value, linear regression adjusted as follows. Model I: maternal age, pre-pregnancy body mass index, parity, history of preterm delivery, baby's sex, nausea during second trimester, smoking habits, passive smoking, nicotine intake from other sources, alcohol consumption during pregnancy, energy intake, maternal education, marital status, household income. In the analysis of the separate caffeine sources, these were mutually adjusted (coffee, caffeinated soft drinks, black tea and chocolate). Model II: as model I, as well as for caffeine intake from different sources as reported at the other studied timepoints.

[b]Caffeinated soft drinks included in Q1 and Q3: Coca Cola/Pepsi with sugar, Coca Cola light, Pepsi Light.

Exponering


51%
5%
22%
7%
7%
7%
Black coffee, all types
Cappuccino and caffè latte
Black tea
Caffeinated soft drinks, artificially sweetened
Caffeinated soft drinks, sugar sweetened (incl energy drinks)
Chocolate, all types
Dessert containing cocoa
Cake containing cocoa
Sweets containing cocoa
Caffeine from supplements
Sandwich spread containing cocoa
Chocolate milk
Decaffeinated coffee