folkehelseinstituttet

Impact of dietary factors in pregnancy on risk of pregnancy complications:

Results from the Norwegian Mother and Child cohort

Helle Margrete Meltzer
Anne Lise Brantsæter
Margaretha Haugen

EARNEST Conference, Munich
May 2010

moba

MoBa-cohort

	Number		Number
Women	90 723	Pregnancies	106 981
Men	72 103	Pregnancies	83 182
Children	108 487	Twins	1 861
		Triplets	21

MoBa-cohort

Number invited	277 706
Number participating	106 981
Participation	38,5%

- First child was borne 26th of October in 1999
- Last one was borne 3rd of July 2009

Dietary data collection

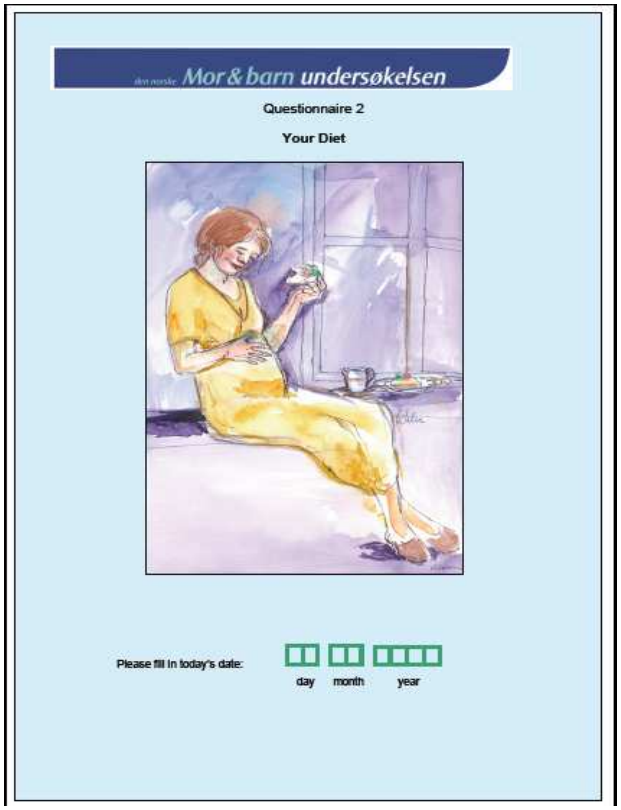
Mother	Ultrasound	QI	Dietary supplements, caffeine and alcohol
	week 22	QII	FFQ, supplements during first 4-5 months of pregnancy
	week 30	QIII	Fish and game intake, supplements, caffeine, alcohol and sweet drinks
Child	6 months	QIV	Lactation and introduction of solid foods, supplements
	18 months	QV	The child's intake of milk, bread, dinners, drinks and cereals/porridge. Supplements
	3 years	QVI	The child's intake of milk, bread, dinners, drinks. Supplements
	7 years	QVII	The child's intake of milk, bread, dinners, drinks. Supplements
	13 years		Plan to assess total diet

How obtain dietary data from 107 000 pregnant women?

Food Frequency Questionnaire (FFQ)

"How often have you, in average, eaten (food --) since you became pregnant?"

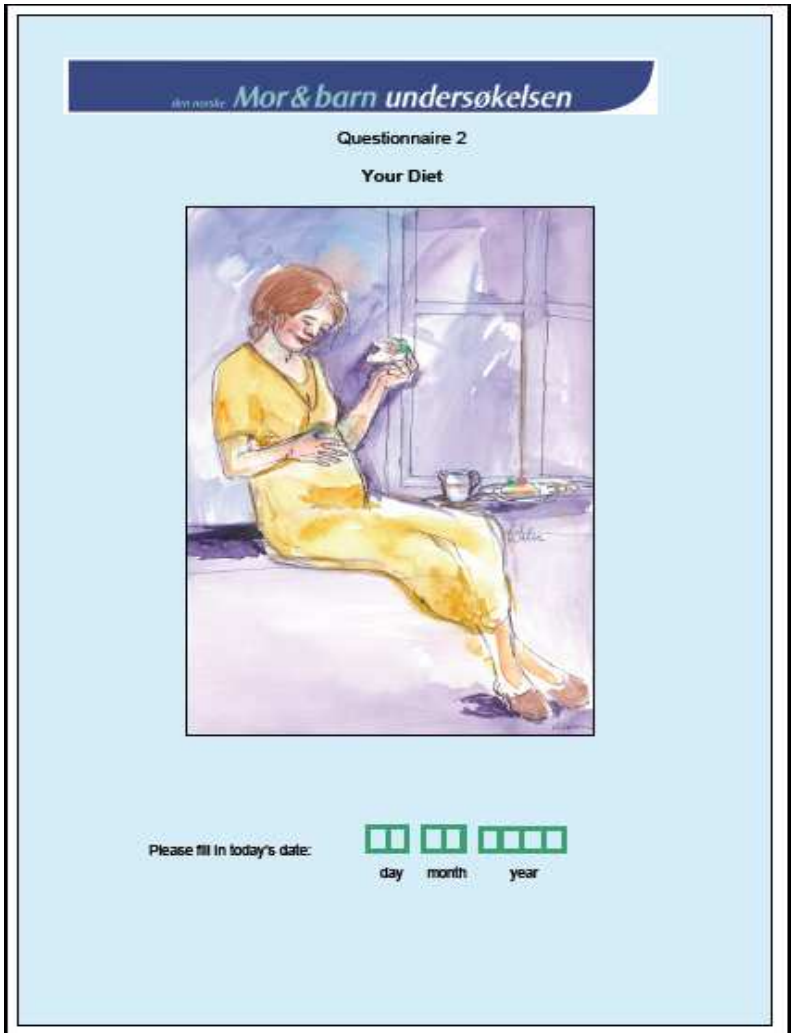
Note number of times per day/week/month
Note size per time (cross at alternatives)


den norske Mor & barn undersøkelsen

Questionnaire 2

Your Diet

Please fill in today's date: day month year



den norske Mor & barn undersøkelsen

Questionnaire 2

Your Diet

Please fill in today's date: day month year

FFQ 16 pages

40 main questions

- Diet- and food habits
- 250 food items
- Changes in pregnancy
- Supplements

Validation of the MoBa FFQ

- Validation study, n=119 Feb 2003 – Feb 2004
- Reference methods: 4-d weighed food diary, 24-h urinary excretion (recovery bm), blood samples (concentration bm) and motion sensor
- Acceptable agreement between the FFQ and the FD for all nutrients and major foods
- Biomarkers confirmed that the FFQ estimates were valid for fruit, juice, vegetables, tea, milk/dairy foods, protein, vitamin D, folate, iodine, n-3 fatty acids
- The MoBa FFQ provide valid estimates of nutrients supplied by dietary supplements

Maternal dietary factors and pregnancy complications

Pregnancy outcomes in MoBa are obtained from the Medical Birth Registry of Norway (MBRN)

Two outcomes have been examined:

- Preterm birth, defined as born before week 37
- Preeclampsia, defined according to established diagnostic criteria

Mediterranean diet and preterm birth

Background: Intervention study among 290 pregnant women with change of diet towards a Mediterranean-type diet resulted in reduced maternal total- and LDL cholesterol concentration and reduced risk of preterm delivery (Khoury et al, 2005)

Aim: to examine if women reporting a Mediterranean - type diet in MoBa had lower risk of preterm birth

Study sample: 26563 women,
inclusion criteria: singleton birth, BMI 19-32, age 21-38, non-smoking, ≤ 3 spontaneous abortions, reliable energy intake

Mediterranean diet and preterm birth

Mediterranean diet defined from reported intake frequencies regarding 5 intake criteria, n=26563

1. Fish ≥ 2 servings/week	66%
2. Fruit & Vegetables ≥5 servings/day	21%
3. Olive- or canola oil for cooking/dressings	80%
4. Red meat ≤2 servings/week	15%
5. Coffee ≤ 2 cups/day	88%

Fulfilled all criteria	569 (2,2%)
Fulfilled no criteria	159 (0,6%)

Results
preterm birth >37 weeks of gestation

n=26563 cases=1174	**Crude OR (95% CI)**	**Adjusted OR (95% CI)**
5 versus 0 criteria	0.71 (0.34, 1.51)	0.73 (0.32, 1.68)
5 versus 1-4 criteria	1.01 (0.68, 1.51)	1.06 (0.71, 1.58)

Adjusted for BMI, parity, height, maternal education and marital status

Results
preterm birth >37 weeks of gestation

Total n: 26563 Preterm: 1174 (4.4%)	**Crude OR (95% CI)**	**Adjusted OR (95% CI)**
Fish ≥ 2 serv/week	0.81 (0.72, 0.93) **	0.84 (0.74, 0.95) *
Olive/canola oil	0.92 (0.80, 1.06)	1.00 (0.86, 1.16)
Fruit/veg ≥ 5 serv/day	0.95 (0.82, 1.10)	0.99 (0.86, 1.15)
Red meat ≤ 2 serv/week	1.09 (0.93, 1.28)	1.09 (0.93, 1.28)
Coffee ≤ 2 cups/day	1.18 (0.98, 1.43)	1.14 (0.94, 1.37)

Adjusted for remaining Mediterranean diet criteria, BMI, parity, height, maternal education and marital status

Implications

Very few women report eating a Mediterranean diet in Norway,

- fruit and vegetables less than 5 times daily
- meat more than twice weekly

Women who fulfilled the criteria of a Mediterranean diet did not have reduced risk of preterm birth

Intake of fish twice or more weekly was associated with a lower risk of preterm birth

Background Preeclampsia studies

Preeclampsia is characterised by endothelial dysfunction, oxidative stress and inflammation. Numerous nutritional targets have been suggested

Associations between dietary components and increased risk of preeclampsia have been found for

- added sugar and soft drinks, excessive energy intake, PUFA (Clausen et al, 1999)
- low intake of milk, low vitamin D status, low intake of fiber (Oken, 2007; Bodnar, 2007; Qiu, 2008)

Preeclampsia studies

Study sample: 23,423 nulliparous women of whom 1267 (5.4%) developed preeclampsia

Inclusion criteria:

- singleton births
- first participation in MoBa
- Energy intake > 4,5 MJ and < 20MJ

Preeclampsia studies

Study 1. Dietary patterns and preeclampsia:

Food intakes (g/d) of 255 food and beverages items were aggregated into 58 food groups and used as input variables to identify dietary patterns

Study 2. Vitamin D, EPA and DHA and preeclampsia:

Intakes of vitamin D and the n-3 fatty acids EPA and DHA from food and dietary supplements were estimated and examined

Both studies: We adjusted for maternal pre-pregnant BMI, maternal height, educational attainment, smoking status, hypertension prior to pregnancy, dietary supplement use, (season) and total energy intake

Study 1: Dietary patterns and preeclampsia

- Dietary patterns were obtained by principal component factor analysis (PCA)
- The components (patterns) are linear combinations of the observed variables (food intakes), correlated variables are grouped together
- For each participant, the factor scores indicate the extent to which her diet conformed to the pattern
- Patterns scores were divided into tertiles and the risk of preeclampsia for T3 versus T1 was evaluated

Results

Four distinct dietary patterns were extracted and named after the nature of the foods with the highest factor loadings within each component:

- a "vegetable" pattern (prudent) characterized by fresh and cooked vegetables, cooking oil, olive oil, fruits and berries, rice, poultry and drinking water
- a "processed food" pattern (western) characterized by processed meat products, white bread, French Fries, salty snacks and sugar-sweetened drinks
- a "potato and fish" pattern (traditional) characterized by cooked potatoes, processed fish, lean fish, fish spread and shellfish, and margarine
- a "cakes and sweets" pattern characterized by cakes, waffles and pancakes, buns, ice-cream, sweets and chocolate.

Results

The "vegetable" and the "processed" patterns scores were oppositely associated with maternal age, education, BMI and smoking

- The "vegetable" pattern mean factor score were positively associated with maternal age, education and height, and negatively associated with BMI and daily smoking
- The "processed food" pattern scores were negatively associated with maternal age, education and height, and positively associated with BMI and daily smoking
- Differences in mean scores were seen for the "potato & fish" and "cakes & sweets" patterns with regard to these characteristics, but the associations were not as clear as for the first two patterns

Results

Associations between tertiles of dietary pattern scores and risk of preeclampsia

Dietary pattern	Total n 23,423	Preeclampsia n	%	Unadjusted OR[1]	(95% CI)	Adjusted OR[3]	(95% CI)
"Vegetable"							
Tertile 1	7807	495	6.3	1		**1**	
Tertile 2	7808	415	5.3	0.82	(0.72, 0.94)	**0.84**	**(0.73, 0.97)**
Tertile 3	7808	357	4.6	0.71	(0.62, 0.82)	**0.72**	**(0.62, 0.85)**
"Processed food"	7807	354	4.5	1		1	
Tertile 1	7808	410	5.3	1.15	(0.99, 1.33)	1.06	(0.91, 1.23)
Tertile 2	7808	503	6.4	1.45	(1.26, 1.67)	**1.21**	**(1.03, 1.41)**
Tertile 3							

[1] Adjusted for other dietary patterns

[3] Adjusted for maternal age, maternal education, maternal height, maternal smoking, total energy intake, hypertension prior to pregnancy and dietary supplement use

Brantsaeter et al: JN 2009; 139: 1162-1168

Results

These results suggest that a dietary pattern characterized by high intake of vegetables, plant foods and vegetable oils decreases the risk of preeclampsia

whereas

a dietary pattern characterized by high consumption of processed meat, sweet drinks and salty snacks increases the risk.

Implications

Pregnancy is a period when most women are highly motivated for dietary advice as changes towards a healthier diet may also benefit their children

Dietary changes have low cost and low risk compared to medical interventions and even a moderate increase in the intake of vegetables and plant foods may be of public health importance

Study 2: Vitamin D, n-3 fatty acids and preeclampsia

Background:

- previous studies had shown lower 25(OH)vitamin D concentration in serum sampled in mid-pregnancy of women who later developed preeclampsia (Bodnar, 2007)
- previous studies had shown contradictory results regarding EPA, DHA and hypertensive disorders/preeclampsia (Oken, 2007; Olafsdottir, 2006)

AIM: To estimate the association between the intake of vitamin D, EPA and DHA in the ordinary diet and as supplements, and preeclampsia

Results

	No	Preeclampsia n (%)	Relative risk (RR) (95 % C.I.)	Adjusted RR (95 % C.I.
Vitamin D from diet (µg/d)				
< 2.5	9140	510 (5.6)	1.0	1.0
2.5 – 4.9	10665	545 (5.1)	0.91 (0.81, 1.03)	0.96 (0.84, 1.09)
5.0 - 7.5	2798	167 (6.0)	1.07 (0.90, 1.29)	1.12 (0.93, 1.34)
> 7.5	820	45 (5.5)	0.98 (0.72, 1.34)	1.03 (0.74, 1.40)
Vitamin D supplements (µg/d)				
no intake	4728	309 (6.5)	1.0	1.0
<5.0	6391	333 (5.2)	0.79 (0.67, 0.92)	0.86 (0.73, 1.01)
5.0 - 9.9	5374	311 (5.8)	0.88 (0.75, 1.03)	0.95 (0.81, 1.13)
10.0 - 14.9	2465	107 (4.3)	0.65 (0.52, 0.81)	**0.73 (0.58, 0.92)**
15.0 - 19.9	1541	69 (4.5)	0.67 (0.51, 0.88)	0.77 (0.59, 1.02)
> 20	2924	138 (4.7)	0.71 (0.58, 0.87)	0.83 (0.68, 1.03)
Total n-3 fatty acids (E%)				
< 0.5	16382	918 (5.6)	1.0	1.0
0.5 – 0.9	4203	222 (5.3)	0.94 (0.81, 1.09)	1.02 (0.87, 1.18)
1.0 – 1.5	2098	90 (4.3)	0.76 (0.61, 0.94)	0.83 (0.66, 1.04)
> 1.5	740	37 (4.3)	0.89 (0.63, 1.24)	0.95 (0.67, 1.33)

Implications

A consistent protective effect of 10 - 15µg/d vitamin D through supplementation

- This correspond to the recommended intake for pregnant women and is equivalent to one spoon of cod-liver oil
- An intake of 10 - 15µg/d can hardly be met without supplementation
- No advantage of an intake above 20µg/d.

Little impact of long-chain n-3 fatty acid intake on preeclampsia risk, but it is difficult to disentangle the separate effects of these nutrients because of a strong collinearity

Haugen et el: Epidemiology 2009 ;20:720-6

Future perspectives

To examine several other pregnancy complications and child outcomes such as birth weight (LGA, SGA), spontaneous preterm birth, gestational weight gain, mode of delivery etc

To examine dietary factors and pregnancy complications taking genetic traits into account

MoBa facilitate the study of maternal versus offspring effects in triads – analyses

More information: www.fhi.no\morogbarn

The diet group in MoBa

Helle Margrete Meltzer

Margaretha Haugen

Jan Alexander

Anne Lise Brantsæter

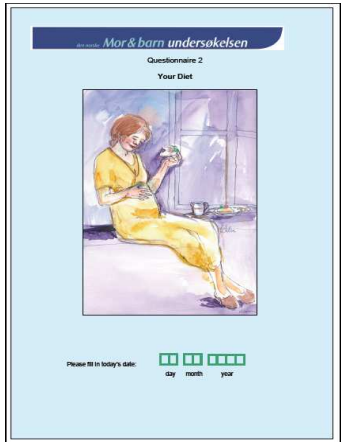
Hanne Torjusen

Helen E Kvalem

Thank you for your attention!

Food frequency questionnaire

per 30.6.2009


Mor & barn undersøkelsen

Questionnaire 2

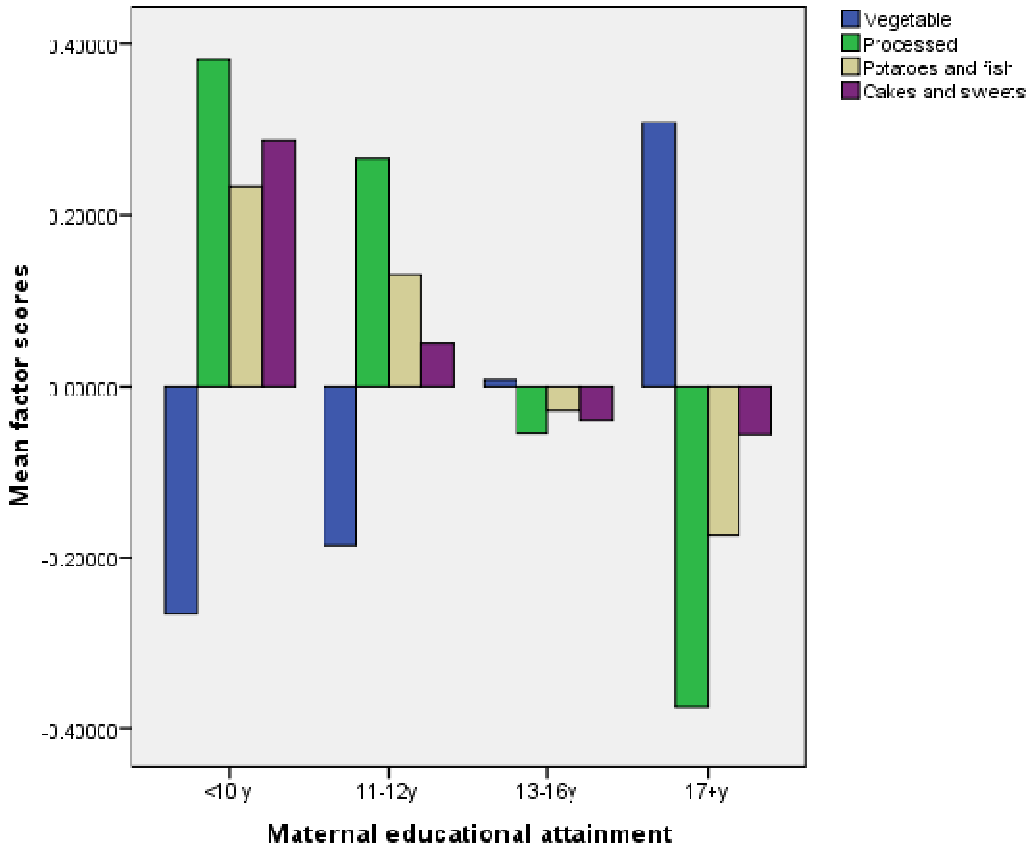
Your Diet

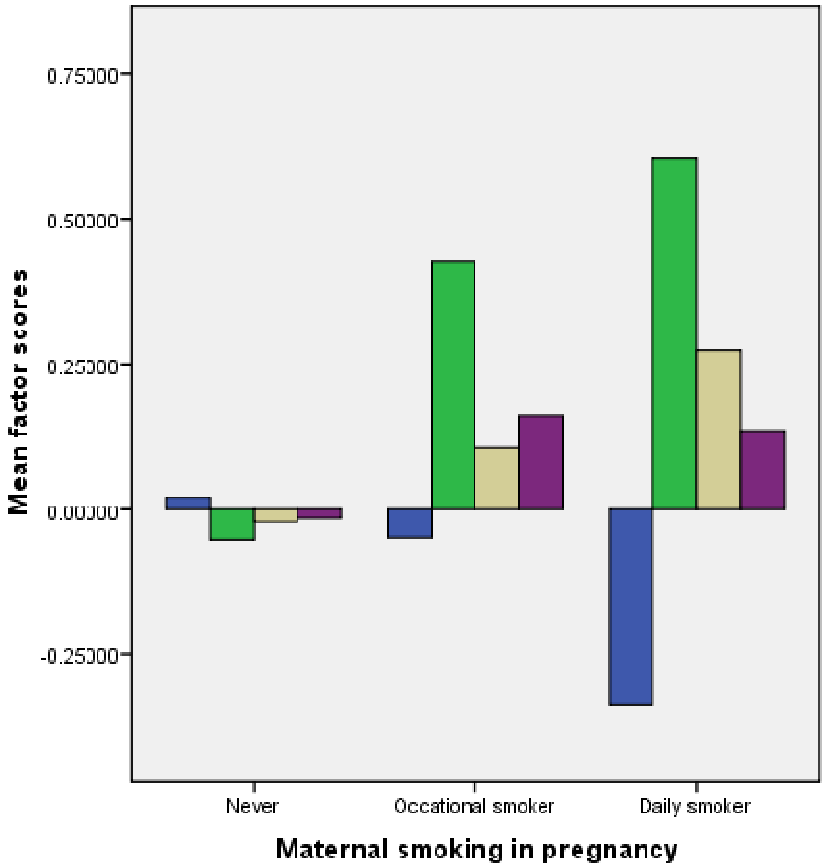
Please fill in today's date:

day month year

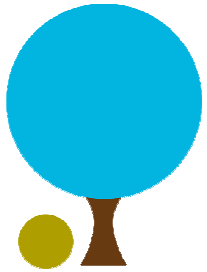
Year	# Invited to answer	Returned Q2	
1999	633	599	94.6%
2000	3022	2696	89.2%
2001	6055	5604	92.6%
2002	10913	10331	94.7%
2003	13060	12469	95.5%
2004	12158	11374	93.6%
2005	16448	15170	92.2%
2006	16176	14801	91.5%
2007	15237	13772	90.4%
2008	10892	9797	89.9%
2009	742	668	90.0%
Total	105336	97281	92.4%

Results


Vegetable
Processed
Potatoes and fish
Cakes and sweets
0.40000
0.20000
0.00000
-0.20000
-0.40000
Mean factor scores
<10 y
11-12y
13-16y
17+y
Maternal educational attainment


0.75000
0.50000
0.25000
0.00000
-0.25000
Mean factor scores
Never
Occational smoker
Daily smoker
Maternal smoking in pregnancy

Results



What is most important; to have high scores on the vegetable patterns or to have low scores on the processed?

PROCESSED PATTERN	VEGETABLE PATTERN		
	Tertile 1	Tertile 2	Tertile 3
Tertile 1	1	0.65 (0.50, 0.85)	0.60 (0.46, 0.78)
Tertile 2	0.92 (0. 73, 1.16)	0.94 (0.75, 1.20)	0.64 (0.49, 0.84)
Tertile 3	1.09 (0.87, 1.38)	0.95 (0.75, 1.20)	0.92 (0.72, 1.18)