Centre for Fetal Programming

STATENS SERUM INSTITUT

# Perspectives for
# ***Danish and Norwegian diet collaboration***

Sjurdur F Olsen

Centre for Fetal Programming / Maternal Nutrition Group
Statens Serum Institut, Copenhagen

Harvard School of Public Health, Boston, USA

# DNBC and MoBa cohort

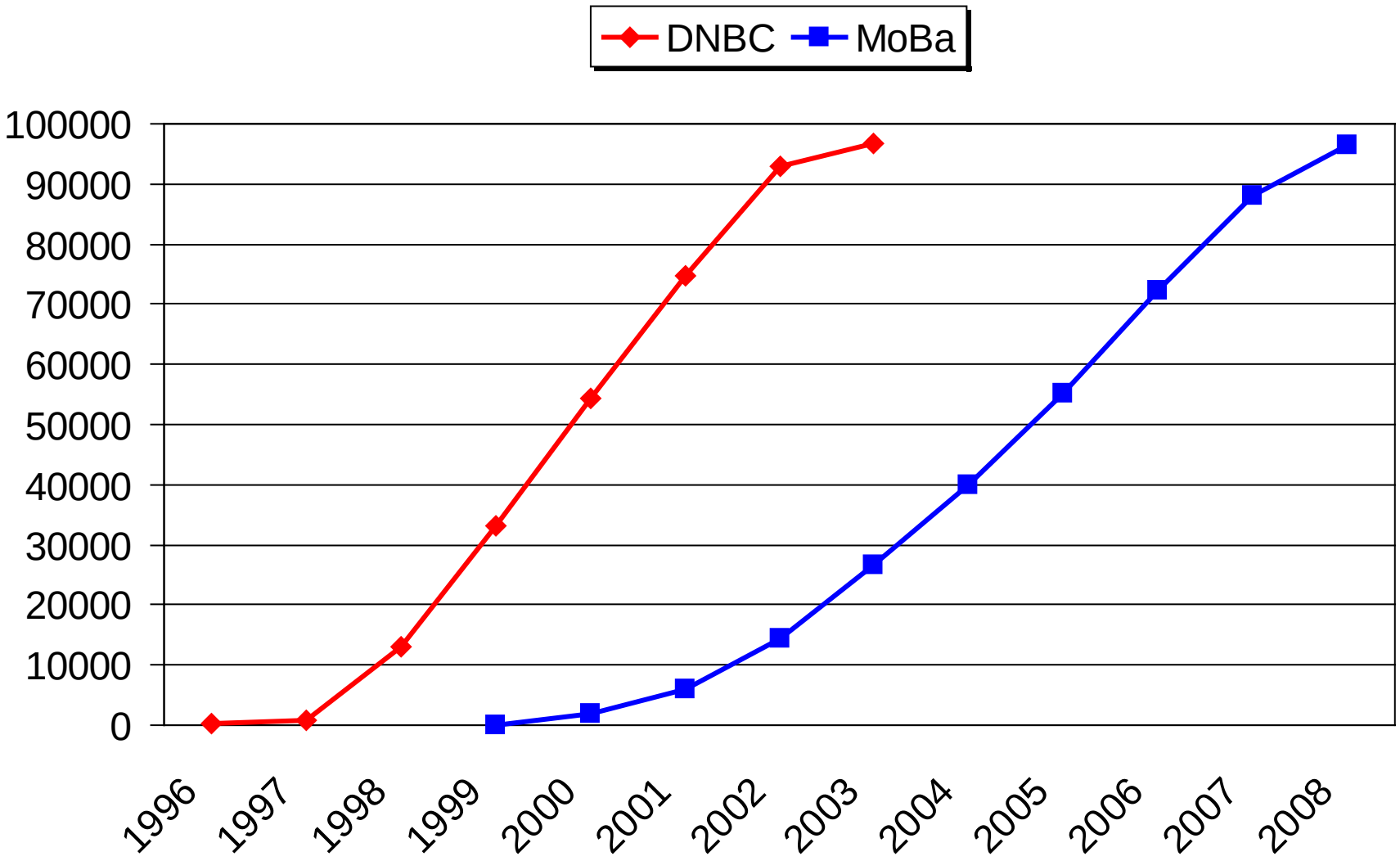
Common history

Share many features

FFQ in pregnancy

FFQ during adolecence

# Number of children born in DNBC and MoBa



DNBC and MoBa dietary groups have been working closely together
for many years

# Settings for Interaction

- Nordisk Arbejdsgruppe for Fiskeriforskning (NAF)
  - Helle Meltzer supervisor for PhD student, Thor Halldorsson
- EARNEST – EU FP6 Integrated Project
  - Our groups met around 10 times during a 5y period
- NEWGENERIS – EU PF6 Integrated Project
- Danish Council for Strategic Research
  - Financed further interaction; visits to Harvard's Nurses Health Study
  - Financed development of a FFQ for 14y olds in both cohorts

# FFQ in pregnancy

# Method to assess pregnancy diet

## Questionnaire in gestation week 25

**Food frequency questions:**

- 19 A4 pages long
- Around 300 food items
- One month back in time (from gw25)
- Fixed time categories
- Fixed food item names

Also questions on food supplements

(Olsen SF et al. Paed Perin Epi 2007)

# Comparison of the two questionnaires

# Article from 2014 in AOGS
## comparing the two questionnaires:
Olsen, Birgisdottir, Halldorsson, Brantsæter, Haugen, Torjusen, Petersen, Strøm, Meltzer

AOGS
ACTA Obstetricia et Gynecologica Scandinavica

AOGS MAIN RESEARCH ARTICLE

**Possibilities and considerations when merging dietary data from the world's two largest pregnancy cohorts: the Danish National Birth Cohort and the Norwegian Mother and Child Cohort Study**

SJURDUR F. OLSEN[1,2,*], BRYNDIS EVA BIRGISDOTTIR[3], THORHALLUR I. HALLDORSSON[1,3,4], ANNE LISE BRANTSÆTER[5], MARGARETHA HAUGEN[5], HANNE TORJUSEN[5,6], SESILJE B. PETERSEN[1], MARIN STRØM[1] & HELLE MARGRETE MELTZER[5,*]

*[1]Centre for Fetal Programming, Department of Epidemiology Research, Statens Serum Institute, Copenhagen, Denmark, [2]Department of Nutrition, Harvard School of Public Health, Boston, Massachusetts, USA, [3]Faculty of Food Science and Nutrition, University of Iceland, Reykjavik, Iceland, [4]Unit for Nutrition Research, Landspitali University Hospital, Reykjavik, Iceland, [5]Division of Environmental Medicine, Norwegian Institute of Public Health, Nydalen, Oslo, and [6]National Institute for Consumer Research (SIFO), Oslo, Norway*

# Main results

**Somewhat different time windows**

- DNBC FFQ: one month during mid-pregnancy
- MoBa FFQ: First half of pregnancy

**Minor difference**

- Time scales in the two questionnaires are given in opposite order

  per day, per week, per month *versus* per month, per week, per day

**Similarities**

- Both FFQs have comparable time scales
- They have similar general structure
- **They have many identical or near-identical items**

**We did**

- Defined 65 food groups that are comparable, or roughly, comparable

~ 65 food detailed food groups

~ 15 aggregated food groups

**Table 2.** The food groups defined for the two dietary databases, and aggregated food groups applied for the current comparison.

| Aggregated food groups | Detailed food groups |
|---|---|
| Vegetables | Cruciferous vegetables |
| | Allium vegetables (onions) |
| | Mushrooms |
| | Corn on the cob |
| | Leafy green vegetables |
| | Tomatoes |
| | Root vegetables |
| | Other vegetables (e.g. avocado, red pepper, cucumber) |
| Fruits | Citrus fruits |
| | Dried fruit |
| | Nordic fruit (e.g. apple, pear, plum) |
| | Fruit from other climates (e.g. grapes, peach) |
| | Bananas |
| | Berries |
| Legumes | Soy-beans and soy products |
| | Peas, green beans and dried beans |
| Nuts | Almonds, hazelnuts, cashew etc. |
| Potatoes | Potatoes boiled |
| French Fries | French fries |
| Meat | Poultry |
| | Pork |
| | Beef, veal, ground beef |
| | Mutton |
| | Mixed meat items (e.g. sausages, meatballs) |
| | Cold cuts, bread spread |
| | Offal |
| Fish | Lean and semi-lean fish (e.g. cod, tuna haddock) |
| | Oily fish (e.g. mackerel, salmon) |
| | Fish topping (bread spread) |
| | Smoked fish |
| | Shellfish |
| Egg | Eggs boiled, fried |
| Rice | Rice |
| Pasta | Pasta, spaghetti |
| Breakfast cereals | Breakfast cereals (e.g. cornflakes, muesli, oat flakes) |
| Wholegrain prod | Wholegrain bread and crisp bread |
| White bread | White bread, buns and sweet biscuits |
| Milk, high fat | Milk high-fat, cream and regular high-fat milk products |
| | Sour cream and cultured high-fat milk products |
| Milk, low fat | Skimmed and semi-skimmed milk |
| Butter | Butter |
| Cheese | Soft cheese (e.g. camembert) |
| | Fresh cheese (e.g. cottage cheese) |
| | Hard cheese |
| Yoghurt | Yoghurt |
| Margarine | Margarines |
| Oil | Vegetables oils for salad dressing, cooking etc. |
| Dressing/sauce | Mayonnaise spreads, dressing and sauce |
| Tea | Black tea, green tea, herb tea |

**Table 2.** Continued

| Aggregated food groups | Detailed food groups |
|---|---|
| Coffee | All types of coffee, filtered, powder, espresso and decaffeinated |
| Soft drinks, sugar | Carbonated, (e.g. soft drinks) and noncarbonated (e.g. cordial, squash) |
| Soft drinks, light | Carbonated and noncarbonated artificially sweetened |
| Juice | Orange juice, apple juice etc. |
| Chocolate milk | Cocoa-containing milk |
| Alcohol | Vine |
| | Beer |
| | Liquors |
| Dessert | Ice cream |
| | Chocolate (chocolate bar, chocolate candy) |
| | Sugary candy, e.g. caramels |
| | Sweet bread spread (Jam, peanut butter etc.) |
| | Sugar in tea/coffee, cake etc. |
| Snack | Crisps, popcorn etc. |

# Comparison of some selected food groups

In MoBa compared to MoBa

- Lower intakes of
  - Milk by 39%
  - Butter by 54%
  - Potatoes by 65%

- Higher intake of
  - Fish by 39%
  - Rice by 141%

- Most other differences were below 20%

# Other types of questions than food-item frequency questions

Example:

Organic food preferences

# Intake of organic foods in pregnancy

Identical questions in the two cohorts about preferences for organic foods during pregnancy :

**“How often do you eat organic foods?”**

Asked for in six food categories:
**milk products, cereals, egg, vegetables, fruit and meat**.

The options were never, sometimes, regularly or always.

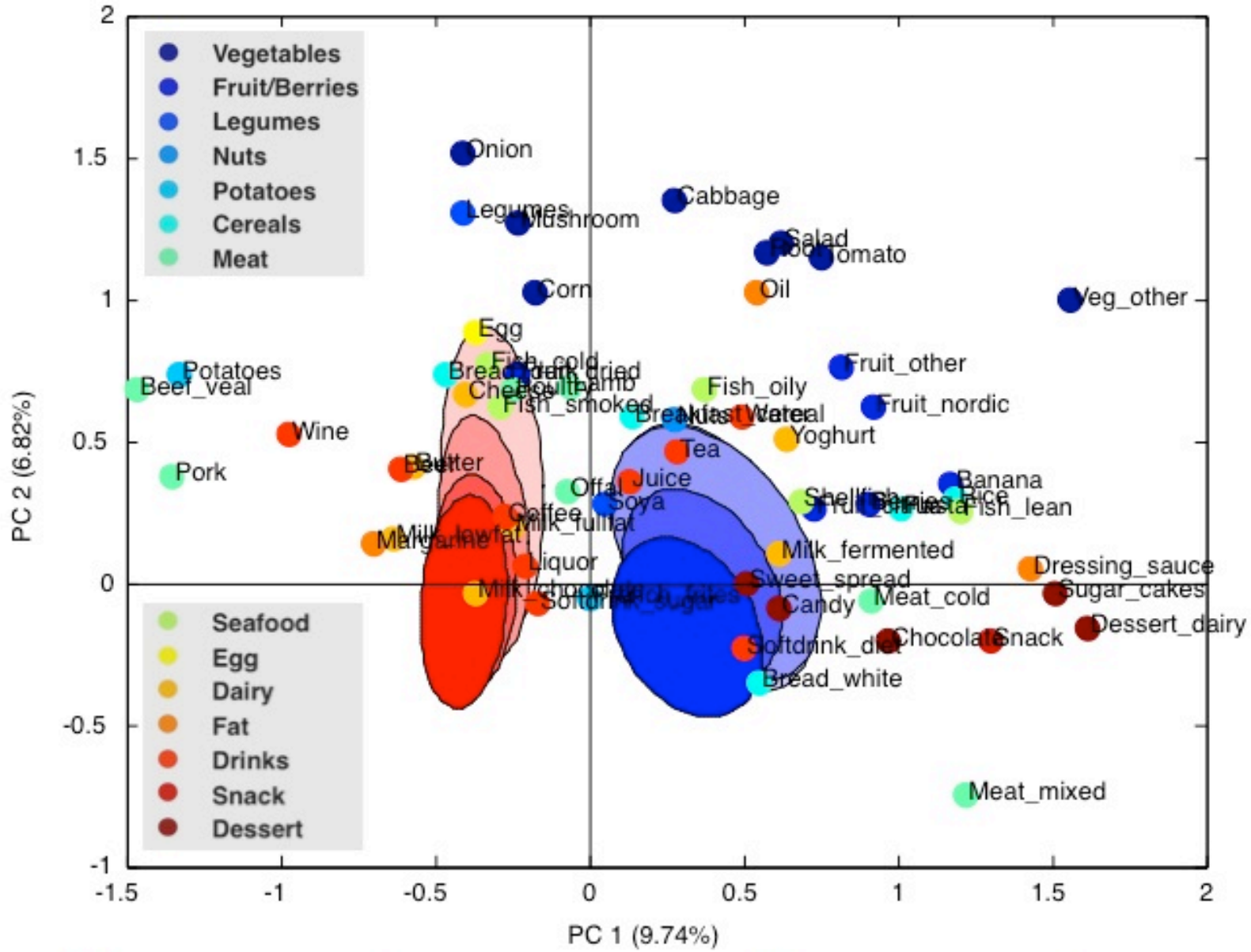
An organic food index, and from this the women were segmented in four groups

# Organic Food Consumption

## DNBC and MoBa comparison

| | Organic user types | | | |
|---|---|---|---|---|
| | **None** | **Rare** | **Moderate** | **Heavy** |
| DNBC | 7,155 | 26,898 | 22,566 | 4,154 |
| | *11,8%* | *37,1%* | *37,1%* | *6,8%* |
| MoBa | 33,864 | 24,911 | 4,865 | 1,233 |
| | *52,2%* | *38,4%* | *7,5%* | *1,9%* |

# PCA plot




**DK:** Non-user → Heavy-user **NO:** Non-user → Heavy-user

# We wish to develop common dietary pattern matrices

Mediterranan type diet

Fruit and vegetables

..and others

# FFQ during adolescence

# DNBC-MoBa collaboration around develping a questionnaire for adolescents

Used the GUTS FFQ questionnaire as basis

GUTS = Growing Up Today Study
i.e. the 2nd generation of the Nurses Health Study

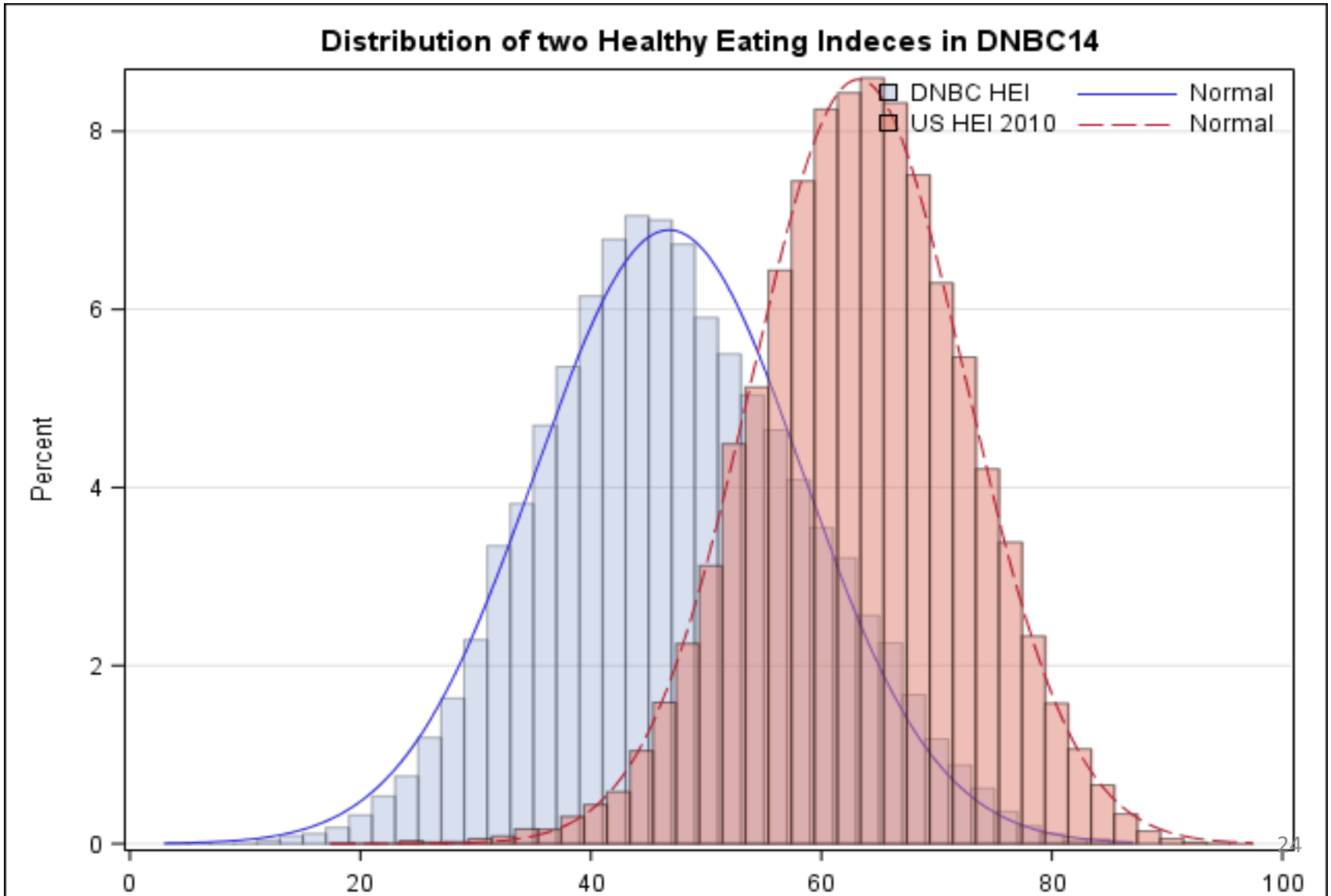
# FFQ – completed by >25,000 14y olds

146 food items divided in to 8 food groups:

- Beverages
- Dairy products
- Bread and cereals
- Spread on bread
- Lunch and dinner meals
- Side dishes
- Fruit and vegetables
- Snack and desserts

- 19 questions regarding height, weight, physical activity level, meal habits, use of supplements and sleep patterns

# Healthy Eating Index, comparison of the US and our definition
n ~ 25,000



# Other collaborative projects between DNBC and MoBa with focus on diet

# Ongoing projects with pooled data

- Vitamin D status markers and childhood diabetes

  Nested case-control study

  ~270 T1D cases in each cohort, ~600 controls

- Protein intake >20%E pregnancy – partitioned according to source (meat, fish, vegetables) – in relation to
  - Preterm risk
  - IUGR risk *(The Harlem Trial in 70s)*

Thank you

**Table**: Components in DNBC Healthy Eating Index and Healthy Eating Index-2010.

| lthy Eating Index DNBC | Healthy Eating Index-2010 | Differences |
|---|---|---|
| and vegetables<br>it>vegetables then *0.5)<br><50 g = 0 points<br>≥600 g = 10 points | Total fruit<br>No intake = 0 points<br>≥8 cup = 5 points | DNBC includes all fruit (also dried) and vegetable (not beans/peas) but excludes juice<br>HEI-2010 includes fruit juice |
| | Whole fruit<br>No intake = 0 points<br>≥4 cup = 5 points | All forms except fruit juice |
| | Total vegetables<br>No intake = 0 points<br>≥ 1.1 cup = 5 points | HEI-2010 includes all beans and peas not counte Total Protein Foods |
| | Greens and Beans<br>No intake = 0 points<br>≥0.2 cup = 5 points | HEI-2010 includes all beans and pes not counted Total Protein Foods |
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| neat<br>>400 g = 0 points<br><200 g = 10 points | Total protein foods<br>No intake = 0 points<br>≥2.5 oz. = 5 points | DNBC includes pork, veal, beef, and lamb<br>HEI-2010 includes beans and peas when the Tota Protein Foods standard is otherwise not met. |
| ssed meat<br>>175g = 0 points<br><70g = 10 points | | DNBC includes meat products such as roast beef sausages, ham, salami etc. |
| ated fatty acids<br>>15E% =0 points<br><10E%=10 points | Fatty acids<br>(PUFA+MUFAs)/SFAs ≤ 1.2 = 0 points<br>(PUFA+MUFAs)/SFAs > 2.5 = 10 points | DNBC includes only SFAs<br>HEI-2010 includes a ratio of PUFA and MUFA to S |
| m<br>>4.5 = 0 point<br>≤2.4g = 10 point | Sodium<br>≥2.g per 1,000 kcal = 0 points<br>≤1.1 g/1,000 kcal = 10 points | DNBC includes sodium form all food sources |
| drinks<br>>500 g = 0 points<br>0 g = 10 points | | DNBC includes carbonated and non-carbonated sugar sweetened beverages, juice and chocolate |
| d sugar<br>>15E% = 0 points<br><10E% = 10 points | Empty calories<br>≥50E% = 0 points<br><=19E% = 20 points | DNBC includes added sugar form all food source<br>HEI-2010 includes calories from solid fats, alcoho and added sugars |

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# Conclusions

- Huge potential in coordinated dietary analyses between MoBA and DNBC
- Should continue harmonizing data and calculatory principles
- Should develop facilities for replication and pooled analyses
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# Method to assess pregnancy diet

## Questionnaire in gestation week 25

**Food frequency questions:**

- 19 A4 pages long
- Around 300 food items
- One month back in time (from gw25)
- Fixed time categories
- Fixed food item names

Also questions on food supplements

(Olsen SF et al. Paed Perin Epi 2007)

# Publications deriving from DNBC using data on maternal diet

## > 50 peer reviewed articles

Outcomes studied: Fetal growth, gestatational weight gain, preterm birth, preeclampsia, gestational diabetes, asthma and allergies

Ongoing: postnatal growth, fracture risk, mental outcomes

ww.cfp-research.com

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# Examples of Projects

- Fish and fish pollutants in pregnancy
- Mediterranean type diet and preterm birth
- Physical activity and preeclamsia
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# Does a Mediterranean type diet protect against preterm birth? (In Scandinavian women?)

# Randomised controlled intervention in Oslo, Norway

- 290 women with normal pregnancies were randomised in mid-pregnancy
  - Intervention group was asked to change their diets towards a Mediterranean type type
  - Control group was not asked to change their dietary habits

**(Khoury et al. Am J Obstet Gynecol 2005)**

# Randomised controlled intervention in Oslo, Norway

- Intervention affected maternal blood lipids in expected direction

- Unexpectedly, a reduction in preterm risk was observed in the intervention group
  - RR 0.10 (95% CI 0.01 to 0.77; p = 0.006)

- Important finding if true, therefore: replication needed!
  - Coordinated analyses in the two large national birth cohorts in Denmark and Norway

# Mediterranean diet

**Khoury's intervention**

Mediterranean diet. 7 criteria:

- Consumption of fish twice a week or more (lunch or dinner)
- Intake of olive or rape seed oil
- High consumption of fruits+vegetables (4-6 a day or more)
- Meat (other than poultry and fish) at most twice a week
- At most 2 cups of coffee a day

# Mediterranean diet

**Possible to mimic Khoury's intervention in DNBC and MoBa**

Mediterranean diet. 7 criteria:

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**Inclusion criteria applied by Khoury:**

.

- Nonsmokers
- BMI between 19 and 32
- Age 21-38 years
- Singleton pregnancy
- No history of habitual spontaneous abortion (>3 times)
- energy intake between 500 and 3500 kcal

.

**Inclusion criteria applied by Khoury, also applicable in DNBC and MoBa:**

- Nonsmokers
- BMI between 19 and 32
- Age 21-38 years
- Singleton pregnancy
- No history of habitual spontaneous abortion (>3 times)
- energy intake between 500 and 3500 kcal

Need to adjust for confounders in observartional study:

- Parity
- BMI (19-25,25-30,30+)
- Height (<165,165-168,169-172,173+)
- Socioeconomic status (categories)
- Single yes/no

# Association between Mediterranean diet and risk of preterm birth

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| | Preterm birth crude OR (95% CI) | Preterm birth adjusted OR (95% CI) |
|---|---|---|
| **Danish cohort**<br>**all criteria met (n=905)**<br>**vs.**<br>**none of the criteria met (n=550)** | 0.79 (0.50,1.27) | 0.61 (0.35,1.05) |
| **Norwegian cohort**<br>**all criteria met (n=569)**<br>**vs.**<br>**None of the criteria met (n=159)** | 0.71 (0.0.34,1.5) | 0.73 (0.32,1.6) |

# Published in two parallel papers

- Margaretha Haugen, Helle Margrete Meltzer, Anne Lise Brantsæter, Tina B Mikkelsen, Marie Louise Østerdal, Jan Alexander, Sjurdur F Olsen, and Leiv Bakketeig. Mediterranean-type diet and risk of preterm birth among women in the Norwegian Mother and Child Cohort Study (MoBa): a prospective cohort study.

  *Acta Obstetricia et Gynecologica Scandinavica 2008;*

  *87:3, 319 - 324*

- Tina B Mikkelsen, Marie Louise Østerdal, Vibeke K. Knudsen, Margaretha Haugen, Helle M. Meltzer, Leiv Bakketeig, and Sjurdur F Olsen. Association between a Mediterranean-type diet and risk of preterm birth among Danish women: a prospective cohort study.

  *Acta Obstetricia et Gynecologica Scandinavica 2008; 87:3, 325 - 330*

# Meta-analysis

Pooling of confounder-adjusted Odds Ratios

All Mediterranean diet criteria met vs. none Mediterranean diet criteria met

- Preterm birth: OR = 0.65 (0.41,1.02)

# Conclusion

- The results tend to support that switching from a Scandinavian to a Mediterranean type diet may reduce risk of preterm delivery

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# Ongoing projects

- Vitamin D status markers and childhood diabetes

  Nested case-control study

  ~270 cases in each cohort

- Dietary patterns and childhood cancer

  ~250 plus ~125 cases

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- Fish and fish pollutants in pregnancy
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- Harmonization of dietary data
- Organic food consumption in pregnancy
- More recent projects:
  - Common FFQ at 14 years
  - Maternal diet and T1DM (incl. biomarker study)

# Main results

**Most important difference is the time window**

- DNBC FFQ: one month during mid-pregnancy
- MoBa FFQ: First half of pregnancy

**Minor difference**

- Time scales in the two questionnaires are given in opposite order

  per day, per week, per month *versus* per month, per week, per day

**Similarities**

- Both FFQs have comparable time scales
- They have similar general structure
- They have many identical or near-identical items

**We did**

- Defined 65 food groups that are comparable, or roughly, comparable

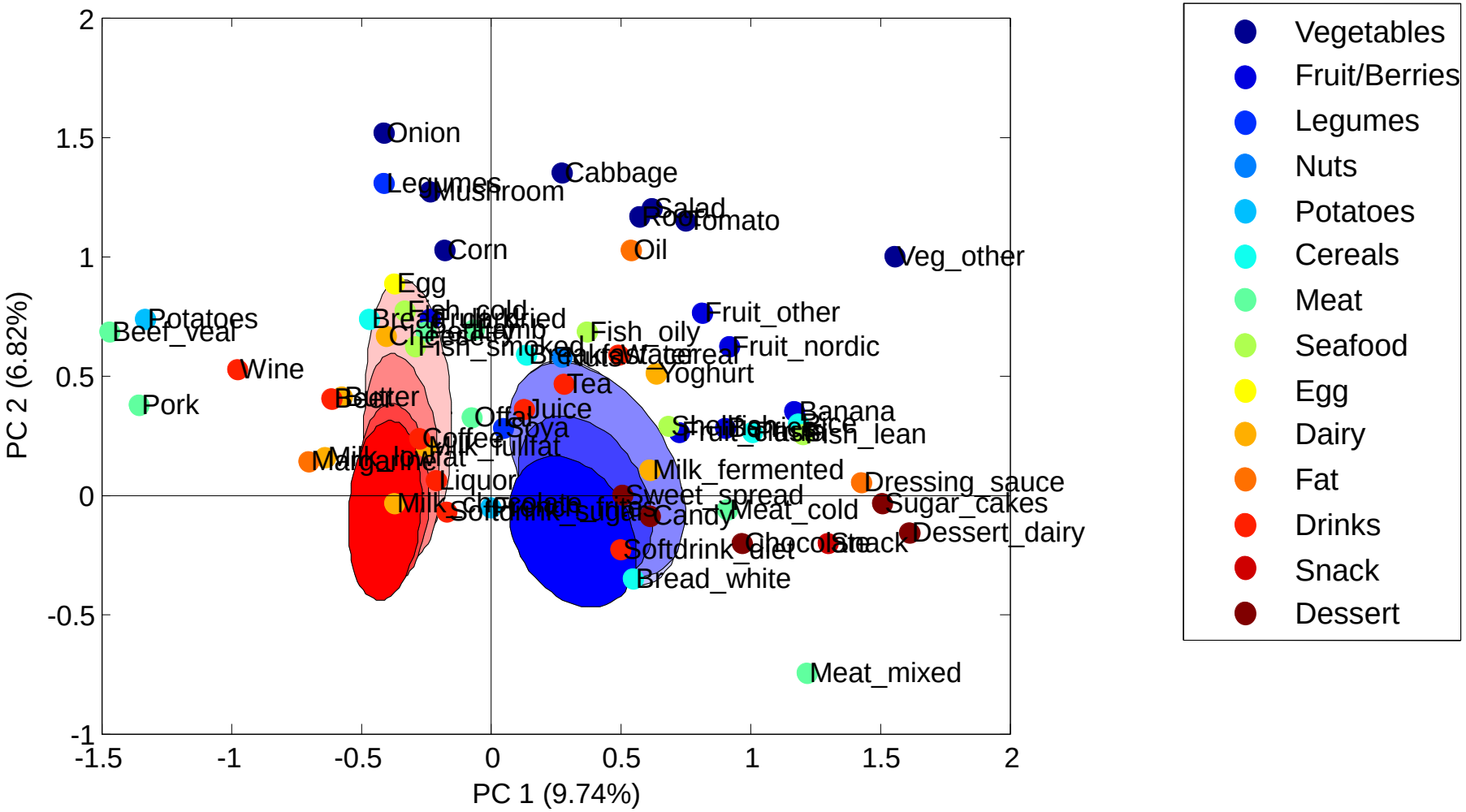
**We should**

- Compare standard portion sizes and recipes
- Compare food tables
- Compare calculatory principles; ideally develop a common programme

Thank you

# PCA DK and NO

## *No correction for anything*



# Intake of organic foods in pregnancy: impact on health

# Intake of organic foods in pregnancy: impact on health

Identical questions in the two cohorts about preferences for organic foods during pregnancy :

**“How often do you eat organic foods?”**

Asked for in six food categories:
**milk products, cereals, egg, vegetables, fruit and meat**

The options were never, sometimes, regularly or always.

An organic food index, and from this the women were segmented in four groups

# Organic Food Consumption

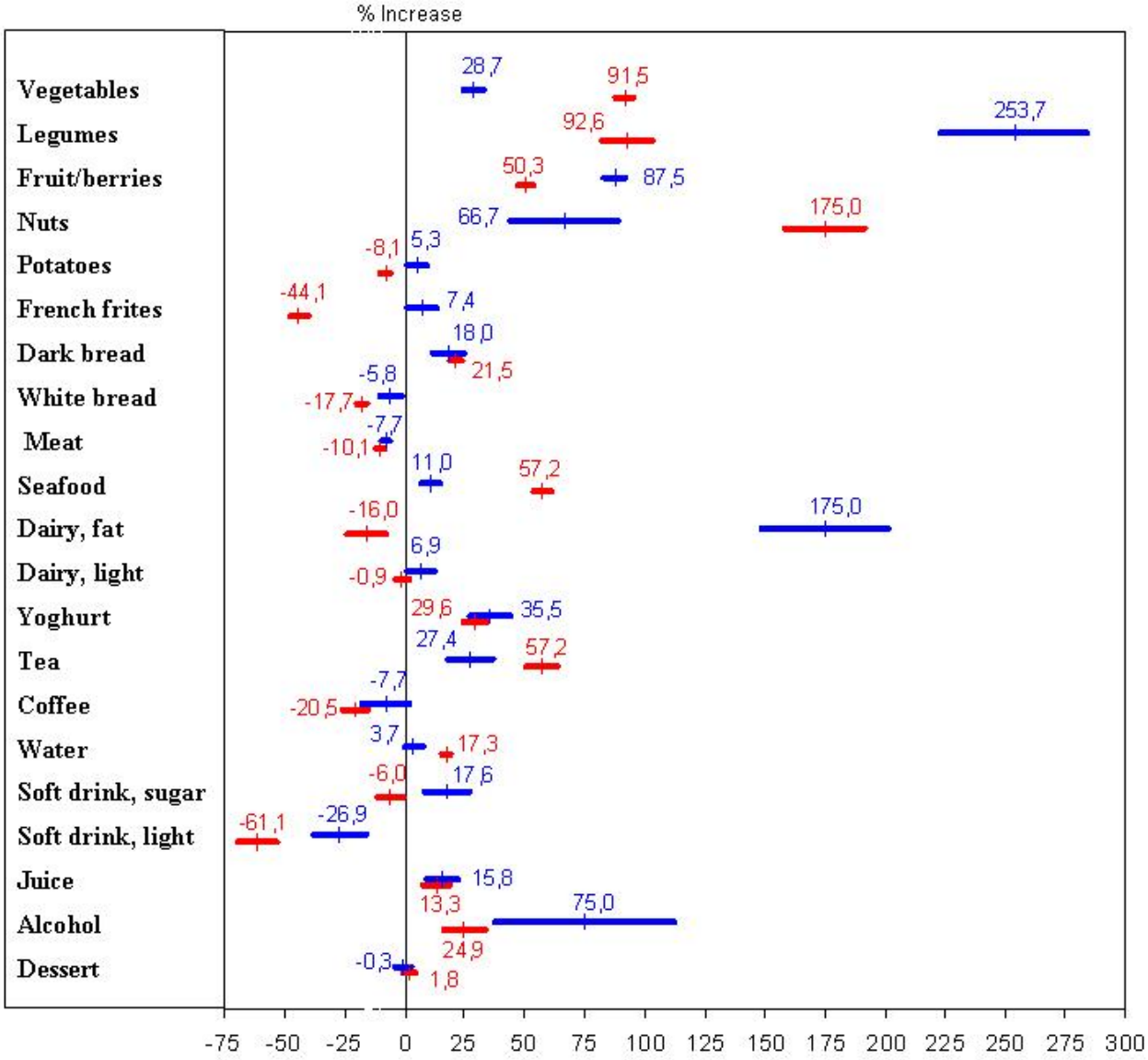
## DNBC and MoBa comparison

| | Organic user types | | | |
|---|---|---|---|---|
| | **Non** | **Rare** | **Moderate** | **Heavy** |
| DNBC | 7,155 | 26,898 | 22,566 | 4,154 |
| | *11,8%* | *37,1%* | *37,1%* | *6,8%* |
| MoBa | 33,864 | 24,911 | 4,865 | 1,233 |
| | *52,2%* | *38,4%* | *7,5%* | *1,9%* |

# Impact of organic food intake in pregnancy on health

1st question:

Do organic food consumers consume a healthier diet in general?




Average difference in percent (heavy-users in proportion to non-users) in dietary intake and 95% CI of picked food groups (DNBC = red, MoBa = blue)

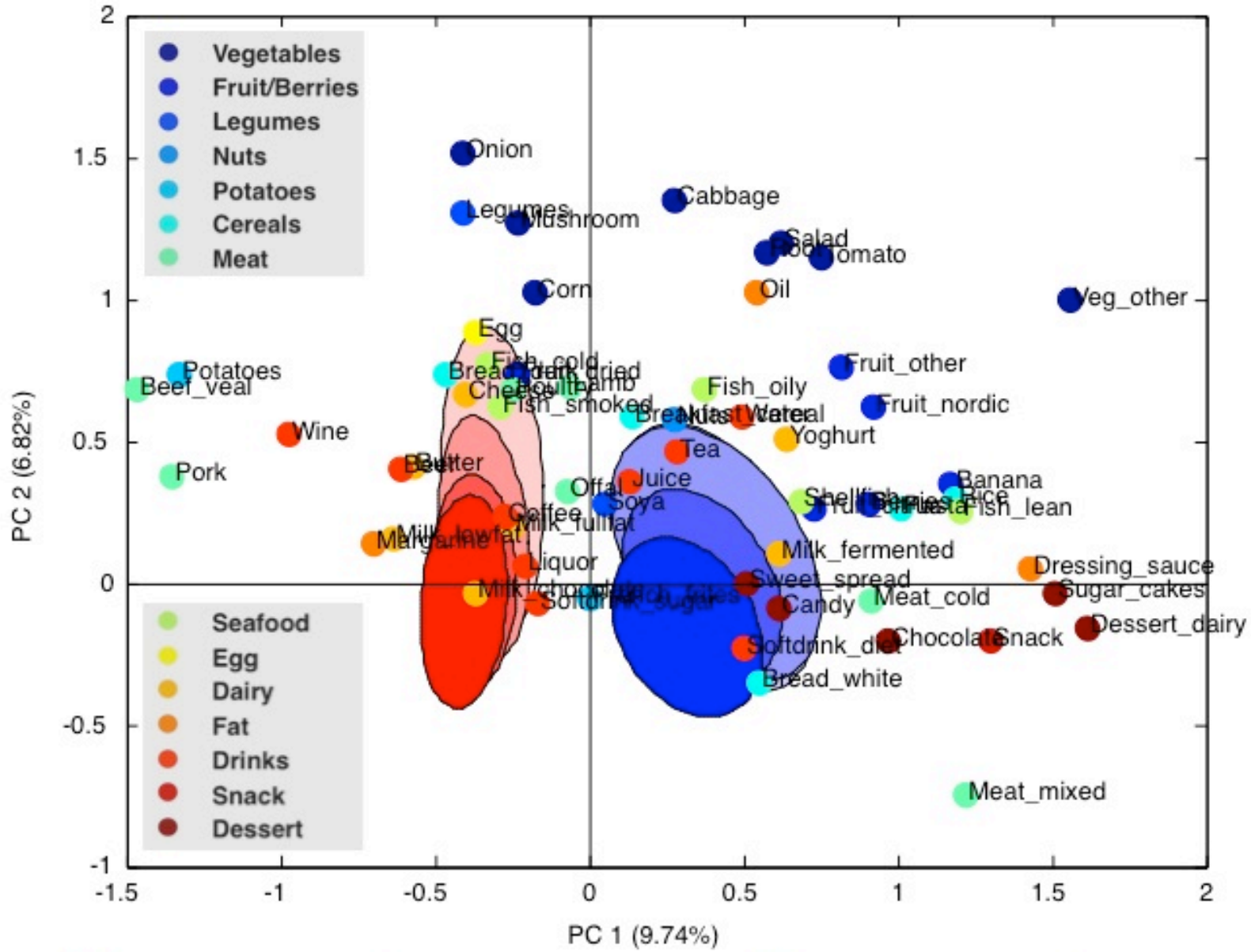
# Organic Food Consumption

## DNBC and MoBa comparison

- The findings point to a major challenge in studies examining impact of organic food consumption on health due to potential confounding by generally healthier food choices in organic food consumers
- How to remedy the confounding by healthier food patterns in these analyses?

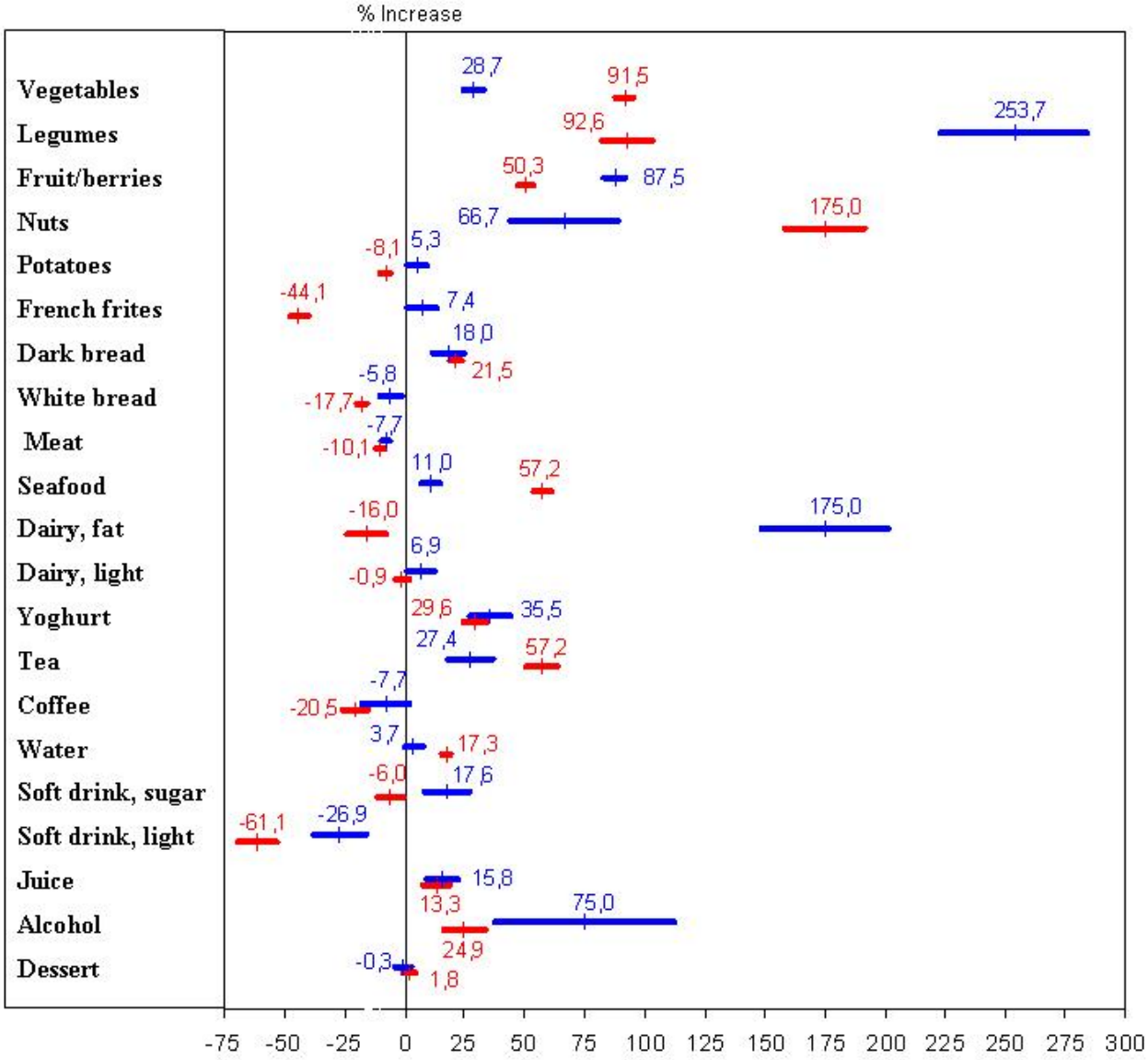
**Next step**

- Food pattern analysis using Principal Component Analysis (PCA)
- Preliminary analysis indicates associations between food groups and organic consumption in both populations




**DK:** Non-user → Heavy-user **NO:** Non-user → Heavy-user

Number of women in the analysis
approx . 70,000 + 80,000




Average difference in percent (heavy-users in proportion to non-users) in dietary intake and 95% CI of picked food groups (DNBC = red, MoBa = blue)

# Impact of organic food intake in pregnancy on health

1st question:

Do organic food consumers consume a healthier diet in general?

**Yes!**

# Organic Food Consumption

## DNBC and MoBa comparison

- The findings point to a major challenge in studies examining impact of organic food consumption on health due to potential confounding by generally healthier food choices in organic food consumers
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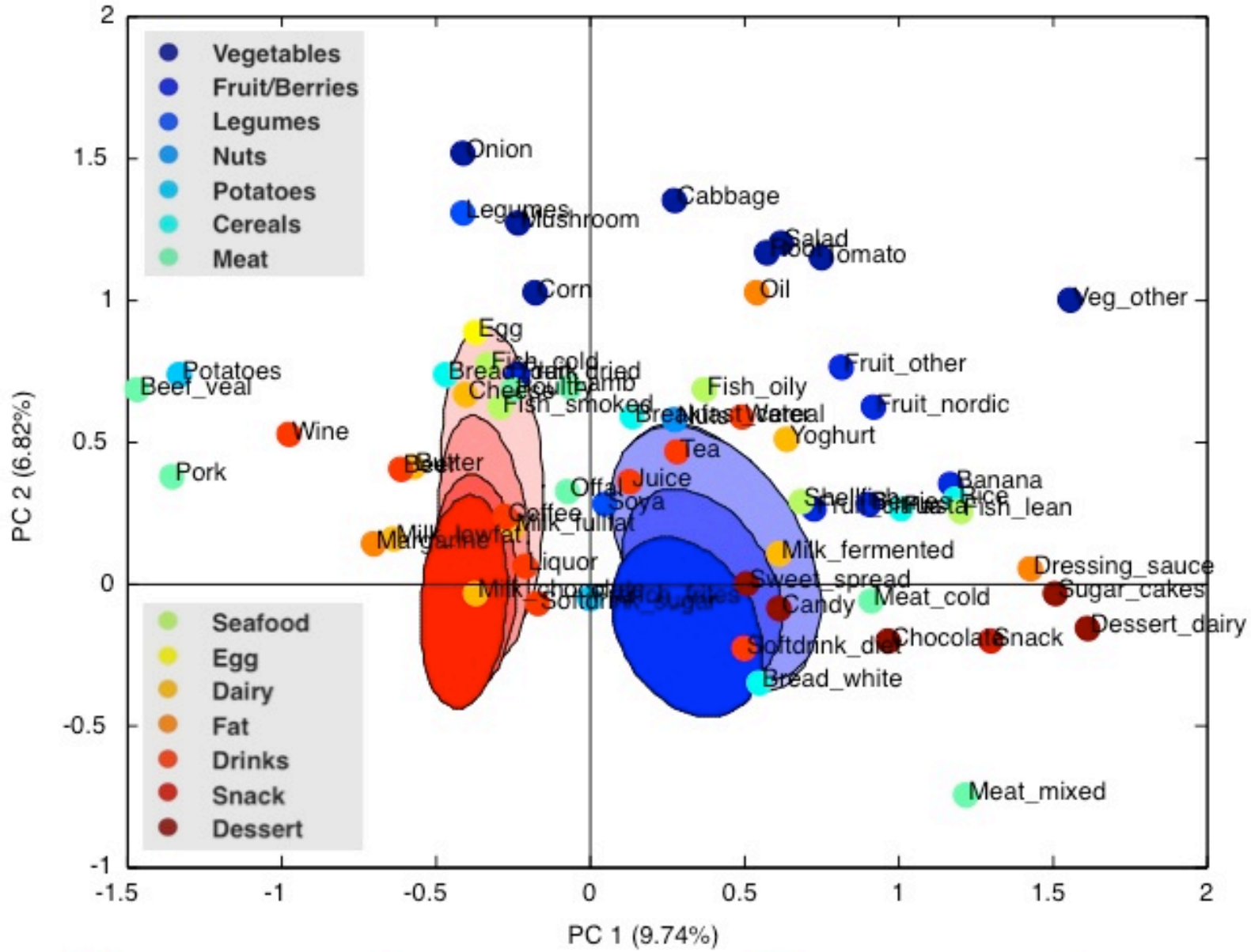


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