The Mab011 data product

Original number of samples	2,984
Number of samples (per 27.11.2023)	2,977
Number of unique participants	2,958
Biological sample type	Whole blood
Participant type(s)	MoBa mothers
Collection timepoint	Gestational week ~17
Case-control selection criteria	None
Biomarker type(s)	Heavy metals and essential elements
Original reference article	Caspersen *et al*. 2019
Analytical method(s)	ICP-MS, CVAFS
Related MoBaBIO product(s)	Mab012, Mab013, Mab014, Pro003, Pro004
FHI Project number(s)	PDB1440

The project that generated these data

Norwegian Environmental Biobank, part I: The importance of nutritional status for the effect of heavy metals on the health of mothers and their children (MoBa-ETox)

Project lead: Line Småstuen Haug

This project formed the first part of the establishment of a Norwegian environmental biobank. The overarching goal of the Norwegian environmental biobank is to monitors levels of nutrients, environmental toxicants, and other unwanted substances in the body over time and examine how these substances affect our health. MoBa-ETox aims to obtain knowledge about nutritional and heavy metal status during pregnancy in the Norwegian Mother, Father and Child Cohort Study (MoBa), and to investigate what significance this may have for subsequent health outcomes in mothers and children. There will be a special focus on whether nutritional status can protect against the negative effects of unwanted environmental substances. The project uses biological samples and questionnaire data from the MoBa to analyze the amount of a selection of nutrients, essential elements and heavy metals in existing MoBa samples from the 2nd trimester of pregnancy, describe the results and assess these in relation to established recommendations and acceptable intakes, and investigate the importance of specific nutrients (vitamins and essential elements) and heavy metals for the risk of developing health problems in later life.

Study population

The original Mab011 biomarker data source is based on whole blood samples from **2,966 mothers** in MoBa who were pregnant in 2002-2008. Mothers were eligible for inclusion if they had completed questionnaires 1–6, if data were available from the father's questionnaire, if they had available blood and urine samples collected in pregnancy, and if they had genetic data available in MoBa. Mothers were ineligible for inclusion based on exclusion criteria applied for genotyping, which included participants who were not registered in the Medical Birth Registry, plural pregnancies, and pregnancies with children with autism, suspected autism, or symptoms of severe language delay. For a more detailed overview of the participant selection procedure in this study, refer to Caspersen *et al*. 2019.

Available biomarker measures (variable names in bold)

Essential elements:

Cobalt (**Co**)
Copper (**Cu**)
Manganese (**Mn**)
Molybdenum (**Mo**)
Selenium (**Se**)
Zinc (**Zn**)

Heavy metals:

Arsenic (**As**)
Cadmium (**Cd**)
Lead (**Pb**)
Mercury (**Hg**)
Thallium (**Tl**)

Biological sampling and processing

Whole blood samples were collected from mothers at 17-18 weeks' gestation into 3 mL trace-free sampling tubes, and shipped from the collecting hospital overnight to MoBa's biobank at the Norwegian Institute of Public Health (NIPH). The samples most often arrived at the biobank within 1–2 days of blood donation, and were placed in long-term storage at a temperature of −80 °C.

For more information on biological sampling, processing and storage, please refer to the original reference articles for NIPH's biobank by Rønningen *et al*. 2006 and Paltiel *et al*. 2014.

Analytical methodology

All determinations (As, Cd, Co, Cu, Mn, Mo, Pb, Se, Tl, Zn) except mercury (Hg) were performed with **inductive coupled plasma mass spectrometry (ICP-MS)** (iCAP Q, Thermo Fisher Scientific, Bremen, GmbH) equipped with collision cell with kinetic energy discrimination and helium as collision gas. For more information, refer to the methods reference article by Barany *et al*. 1997.

Mercury (Hg) was determined as total Hg in acid-digested samples by **cold vapor atomic fluorescence spectrophotometry (CVAFS)**. For more information, refer to the methods reference article by Sandborgh-Englund *et al*. 1998.

For more detailed information of the methods used in this study, you may refer to the original reference article for this dataset Caspersen *et al*. 2019, as well as the specific methods description documentation developed by the project study group in MoBa-ETox. This will be provided to approved studies in accompaniment of biological datasets.

Measurement units:
Concentration in **µg/L** for all measures.

Limit of quantification (LOQ):
Arsenic (As): 0.03 µg/L
Cadmium (Cd): 0.03 µg/L
Cobalt (Co): 0.04 µg/L
Copper (Cu): 1.20 µg/L
Lead (Pb): 0.08 µg/L

Manganese (Mn): 0.18 µg/L
Mercury (Hg): 0.07 µg/L
Molybdenum (Mo): 0.11 µg/L
Selenium (Se): 3.20 µg/L
Thallium (Tl): 0.03 µg/L
Zinc (Zn): 30.00 µg/L

Published articles using Mab011

This section also includes articles related to study design, sampling, and data collection.

- Kelsey PT, Papadopoulou E, Borge TC, et al. Ultra-processed food consumption and associations with biomarkers of nutrition and inflammation in pregnancy: The Norwegian Environmental Biobank. Front Nutr. 2022 Dec 8;9:1052001.
- Vejrup K, Brantsæter AL, Meltzer HM, et al. Prenatal mercury exposure, fish intake and child emotional behavioural regulation in the Norwegian Mother, Father and Child Cohort Study. BMJ Nutr Prev Health. 2022 Nov 15;5(2):313-320.
- Holmquist E, Brantsæter AL, Meltzer HM, Jacobsson B, Barman M, Sengpiel V. Maternal selenium intake and selenium status during pregnancy in relation to preeclampsia and pregnancy-induced hypertension in a large Norwegian Pregnancy Cohort Study. Sci Total Environ. 2021 Dec 1;798:149271.
- Papadopoulou E, Botton J, Caspersen IH, et al. Maternal seafood intake during pregnancy, prenatal mercury exposure and child body mass index trajectories up to 8 years. Int J Epidemiol. 2021 Aug 30;50(4):1134-1146.
- Skogheim TS, Weyde KVF, Engel SM, et al. Metal and essential element concentrations during pregnancy and associations with autism spectrum disorder and attention-deficit/hyperactivity disorder in children. Environ Int. 2021 Jul;152:106468.
- Modzelewska D, Solé-Navais P, Brantsæter AL, et al. Maternal Dietary Selenium Intake during Pregnancy and Neonatal Outcomes in the Norwegian Mother, Father, and Child Cohort Study. Nutrients. 2021 Apr 9;13(4):1239.
- Solé-Navais P, Brantsæter AL, Caspersen IH, et al. Maternal Dietary Selenium Intake during Pregnancy Is Associated with Higher Birth Weight and Lower Risk of Small for Gestational Age Births in the Norwegian Mother, Father and Child Cohort Study. Nutrients. 2020 Dec 23;13(1):23.
- Barman M, Brantsæter AL, Nilsson S, et al. Maternal dietary selenium intake is associated with increased gestational length and decreased risk of preterm delivery. Br J Nutr. 2020 Jan 28;123(2):209-219.
- Nakayama SF, Espina C, Kamijima M, et al. Benefits of cooperation among large-scale cohort studies and human biomonitoring projects in environmental health research: An exercise in blood lead analysis of the Environment and Child Health International Birth Cohort Group. Int J Hyg Environ Health. 2019 Sep;222(8):1059-1067.
- Caspersen IH, Thomsen C, Haug LS, et al. Patterns and dietary determinants of essential and toxic elements in blood measured in mid-pregnancy: The Norwegian Environmental Biobank. Sci Total Environ. 2019 Jun 25;671:299-308.
- Vejrup K, Brandlistuen RE, Brantsæter AL, et al. Prenatal mercury exposure, maternal seafood consumption and associations with child language at five years. Environ Int. 2018 Jan;110:71-79.

Restrictions for use

None currently known.

Acknowledgements recommended for use

We recommend that any use of these data in analyses that are presented in peer-review publications acknowledges the original articles describing sampling and data collection:

Caspersen IH, Thomsen C, Haug LS, et al. Patterns and dietary determinants of essential and toxic elements in blood measured in mid-pregnancy: The Norwegian Environmental Biobank. Sci Total Environ. 2019 Jun 25;671:299-308.

Disclaimer

The data in Mab011 that are available for use are provided by MoBa on an *as is* basis as they were received from the generating laboratory and have not been curated or quality controlled prior to release. FHI does not provide any guarantees related to data quality and assurance of the original dataset. We reserve the right to periodically remove samples from the dataset belonging to participants who have retracted their consent to participate in this cohort study, and may alter the contents of the associated documentation accordingly.