

Brain scans of preterm babies could reveal best feeding for brain development

June 20 2018



Babies born early, like Aria Markham, could benefit from the findings of the new study. Credit: University of Auckland

Brain scans of days-old premature babies could help researchers determine the best feeding style for brain development, lowering the

babies' risk of learning difficulties.

The world-first study will be led by Distinguished Professor Jane Harding at the University of Auckland-based Liggins Institute in collaboration with Professor Steve Miller from the renowned Hospital for Sick Children in Toronto, Canada. It will run at Auckland City, North Shore, Waitakere and Middlemore hospitals.

Researchers will take MRI scans of [preterm babies](#)' brains a few days after birth, and then again at their due date, to see how nutrition in the first days, while the [babies](#) are still learning how to breastfeed, affects [brain growth](#) and development.

Today, the researchers received \$1.2 million in funding from the Health Research Council (HRC) to begin the study, which will involve 96 babies born at 32-36 weeks' gestation.

Professor Harding: "We hope this study will allow us to identify ways of feeding these babies that will enhance their [brain](#) development. It's exciting not only because this is the first time anyone has looked at the effect of nutrition on brain growth and development in moderate-to-late preterm babies, but also because it will help us develop new techniques in collaboration with world experts."

For the MRI scans, the researchers will use a technique pioneered in Toronto. "We feed the babies, tuck them up in a special incubator that is compatible with the MRI scanner, and wait for them to go sleep, so they keep still during the scan. Then we slide the whole incubator into the MRI machine so the baby is not disturbed."

The scan takes 30-40 minutes – cut short if the baby wakes up – and is completely safe. Professor Harding: "MRI has been used for many years as a routine assessment of even the tiniest preterm babies in many

hospitals overseas. It is non-invasive, involves no radiation and has no known side effects."

Every year, around 5000 babies are born preterm in Aotearoa New Zealand. The vast majority survive, but they carry a greater risk of problems with growth, learning, and adult diseases such as obesity and diabetes than babies born at term.

The new study builds on the Liggins Institute-led DIAMOND study, which is comparing different ways of providing nutritional support to preterm babies learning how to breastfeed. Researchers believe that optimising how and what preterm babies are fed in those critical first days or weeks could prevent diseases later in life and help intellectual development.

"Nutrition offers the simplest and least expensive way of improving the long-term health for these babies," says DIAMOND study lead Professor Frank Bloomfield, Director of the Institute. "It's the first step towards personalised medicine for preterm babies."

Preterm babies face many difficulties with feeding. It can take days before their mothers start producing enough breast milk, and up to weeks before the baby's gut is mature enough to tolerate the milk. For preterm babies born at 32-36 weeks, there is almost no evidence to guide doctors on how best to feed babies in this period, and practice varies widely. One common approach is to give babies a sugar solution intravenously (into their veins) while gradually increasing the amount of milk fed via a nasogastric tube down the nose into the stomach, finally shifting to breastfeeds when the baby is ready.



Credit: University of Auckland

The main DIAMOND study has been running for 18 months. Babies are randomly allocated to receive intravenously just sugar water or sugar water plus protein. They also either receive a specially formulated human milk substitute via the feeding tube while waiting for mother's breast milk supply to build up, or just wait until the breast milk is available. On top of this, half are helped to smell and taste a few drops of milk before the tube-feed, as evidence from a pilot study suggests this may help them feed earlier.

Researchers in the new brain MRI study have proposed that giving babies protein-boosted sugar water intravenously may affect how the cerebral cortex – responsible for high level brain functions – matures. They also propose that breastmilk may support developing connections

between nerve cells, and that exposure to the smell and taste of milk before a tube-feed may alter maturation of the thalamus – an important co-ordinating centre at the base of the brain.

Professor Harding: "Better early brain growth and maturation is associated with better development as the babies get older. If we can pinpoint the feeding approach that best supports early brain development, we may significantly lower the risks of these babies experiencing learning difficulties later in life."

DIAMOND baby Aria's story

North Shore couple Deborah and Steven Markham had just driven back from a birthday party in Coromandel when Deborah's waters broke. Her baby – their first – wasn't due for another five weeks, so she called her midwife, who told her to go into the hospital. "Her arriving early was completely unexpected," says Deborah.

Within 12 hours, Aria was born. A healthy 2.5kg, she needed to be placed under special lights to prevent jaundice, and spent 10 days in hospital.

The day after she was born, a research assistant approached Deborah to ask if she would like to join the DIAMOND study, which is looking at different ways to provide nutritional support to preterm babies learning how to breastfeed. Researchers believe that optimising nutrition in those critical first days following birth could prevent diseases later in life and help intellectual development.

"She came in and chatted to us, and gave us a brief rundown about the study. I talked it over with Steven, and when she came back that afternoon we agreed straight away to be part of the study," says Deborah. "We saw it as a great opportunity to help other preterm babies in the

future. And they made it quite clear from the start that the study wouldn't change anything about how we wanted to feed her, which was breastfeeding."

Aria—now a healthy, happy eight month old—was randomly selected to receive a sugar solution intravenously (into the veins) in the three or four days before she started breastfeeding. Researchers took several 2 ml samples of Deborah's breastmilk and measured Aria's weight, length, body fat and lean body mass. They repeated those measurements at four months, with another follow-up due at age two.

"There wasn't any inconvenience to us, we didn't have to change anything about how we looked after Aria," says Deborah.

Deborah says she would have been happy for Aria to undergo a safe, non-invasive MRI brain scan too – something that will be possible now for future DIAMOND babies, who will be invited to join a new, parallel study that will investigate how the different feeding approaches affect preterm babies' brain growth and development.

"That's a great idea to see the effect of each feeding method," she says. "And probably interesting for the parents as well to see how their baby's brain development is progressing."

Provided by University of Auckland

Citation: Brain scans of preterm babies could reveal best feeding for brain development (2018, June 20) retrieved 23 April 2024 from <https://medicalxpress.com/news/2018-06-brain-scans-preterm-babies-reveal.html>

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