

# ADVANCES FOR PRE- AND POST-NATAL NOURISHMENT

Studies investigate how a pregnant woman’s **PROTEIN INTAKE** and **BREAST-FEEDING ROUTINE** might be affecting an infant’s lifelong health.

Through the development of a more accurate way to assess protein intake by pregnant women, researchers at dairy products company Morinaga Milk Industry are gleaning fresh insights into low birth weights. In tandem, another team at the company is looking at the complicated link between breast milk and infant immune function.

These studies come in the wake of a 2017 national survey by Japan’s Ministry of Health, Labour and Welfare that showed pregnant Japanese women had an average energy intake below the recommended minimum standards in all three trimesters. Even more concerning is their average protein intake during the key third trimester is below the recommended dietary allowance. This may help explain why the proportion of low birth weight deliveries in Japan in 2017 was 9.4%, while the average among OECD countries was 6.5%.

“Protein is one of the fundamental building blocks for the body. When insufficient in the mother, babies are likely born smaller,” explains Yasuaki Wada, a researcher

at Morinaga Milk. “A recent systematic review has also shown a beneficial effect of sufficient protein intake in preventing preterm birth.” Low birth weight infants have both a higher risk of mortality and of developing lifestyle diseases later in life.

**AVERAGE PROTEIN INTAKE DURING THE KEY THIRD TRIMESTER IS BELOW THE RECOMMENDED**

But measuring protein undernutrition in pregnant women is challenging. Wada and his team are working on a new, more accurate method using the redox state of serum albumin, one of the main components in blood. Serum albumin concentration has long been a common index for inferring protein nutritional states. “From a scientific point of view, however, it’s becoming less supported as an indicator of protein nutritional status, as it is also affected by non-nutritional factors, including inflammation,” says Wada. “It’s particularly unsuitable

for pregnant women, as their blood volume increases during pregnancy which dilutes the albumin concentration. This makes protein nutritional status look poor.”

Wada’s alternative is to assess the different forms of albumin instead. Albumin can take both reduced and oxidized forms, and studies by Wada over the past six years have shown that the ratio of these forms is sensitive to protein nutritional status. “Our research started out seeking to combat the muscle wasting syndrome sarcopenia, as well as frailty in the elderly, but it seems applicable to pregnant women as well,” he says. “Because this involves measuring the ratio of reduced and oxidized forms of albumin, it is unaffected by fluctuations in blood volume.”

Using this measure, researchers have already observed that protein undernutrition is correlated with low birth weight.

However, we need to validate whether dietary habits and nutritional states truly relate to low birth weight,” says Wada. “If we find an association, then the next step

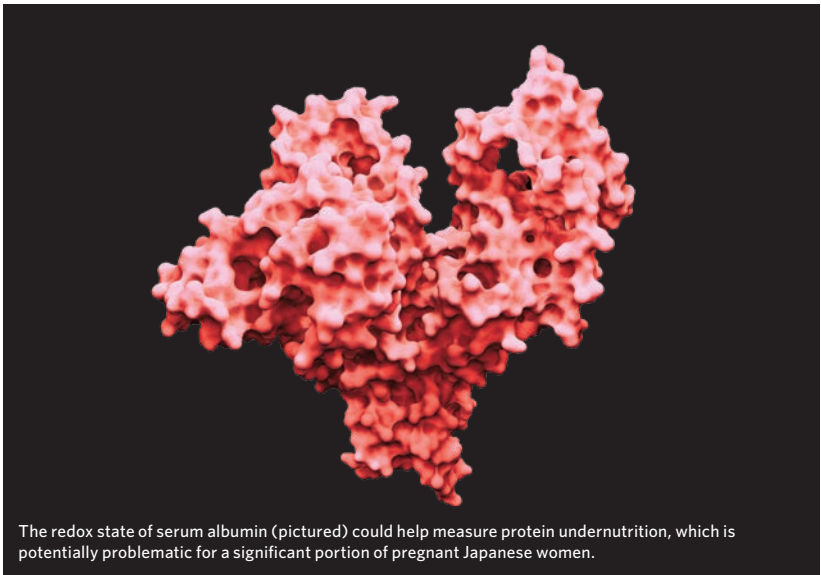
would be to develop nutritional interventions for women to prevent low birth weight delivery.”

## BREAST MILK AND INFANT GUT MICROBIOTA

Milk composition varies widely between mammalian species and human breast milk is considered optimal for human infants. In fact, breast-fed infants have lower infection rates than those who are formula-fed. “There are several biologically functional components like anti-microbial proteins in milk. And we think those functional components are important for infant health,” explains Hirohisa Izumi, another researcher at Morinaga Milk.

However, the role of most biological components remained elusive. “To this day, we keep finding new components in breast milk,” says Izumi. “We still don’t have a consensus on what many of those components do.”

Gut microbiota is also different between breast-fed and formula-fed infants. An example is *Bifidobacterium*, a class of bacteria found more abundantly in infants raised exclusively on breast milk.

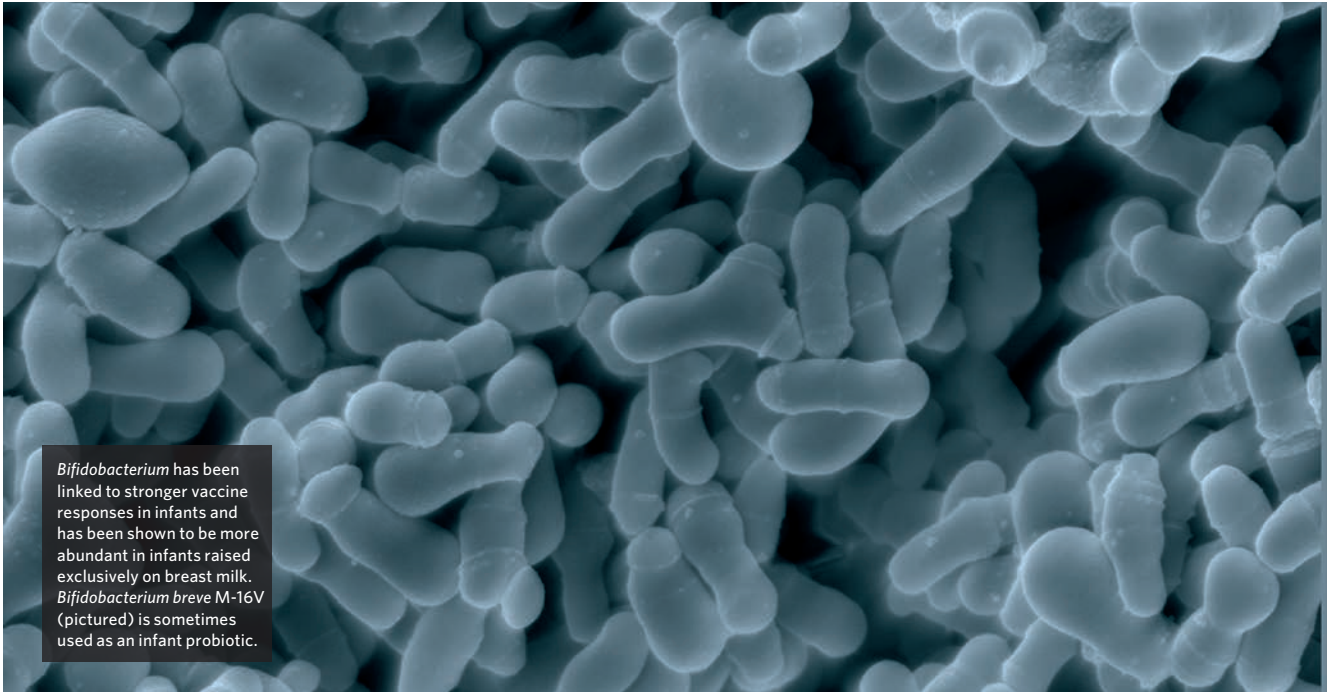


The redox state of serum albumin (pictured) could help measure protein undernutrition, which is potentially problematic for a significant portion of pregnant Japanese women.

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Morinaga Milk Industry researchers study new components in breast milk.



*Bifidobacterium* has been linked to stronger vaccine responses in infants and has been shown to be more abundant in infants raised exclusively on breast milk. *Bifidobacterium breve* M-16V (pictured) is sometimes used as an infant probiotic.

“*Bifidobacterium* is active in a number of ways, including the production of acetic acid with strong antibacterial properties,” Izumi explains. “Studies have also shown that infants with more *Bifidobacterium* show a positive association with vaccine responses, such as oral polio vaccines. Considering the importance of *Bifidobacterium* for infants, Morinaga Milk has provided *Bifidobacterium breve* M-16V to more than

140 facilities so far, including newborn intensive care units in Japan.” The researchers have also been looking more closely at gut microbiota and immune responses in projects run through the Hokkaido University Center of Innovation. It appears that there isn’t a one-to-one correlation, says Izumi, as preliminary results from a longitudinal study in the city of Iwamizawa in Hokkaido

suggest that although raised primarily on breast milk, some infants have low levels of *Bifidobacterium*. “The picture is complex, with myriad factors likely at play.” The team will need to unpack these findings, as well as the role of other bacteria and metabolites in infant microbiota. Other age groups also stand to benefit. “The nutrients that we uncover within breast milk or other compounds vital to

infant health could very well be relevant to people of other ages too,” says Izumi. Wada agrees: “There is no reason not to apply what we learn to devise recommendations for the frail elderly.” ■



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