

## Effects of Soy Baby Formula on Intestinal Development

Two studies by University of Illinois food science and human nutrition professor Sharon Donovan show that the soy isoflavone genistein, in amounts present in commercial soy infant formulas, may inhibit intestinal cell growth in babies. So what are we to think about soy in a baby's diet?

Donovan said it's an important question to ask because almost 25 percent of formula-fed babies in the United States consume soy formula. Although babies on soy formula appear to grow normally, these formulas contain very high concentrations of genistein, from 32 to 45 milligrams, which is higher than the amount found to affect menstrual cycles in women, she said.

"I'm struck by the fact that these babies are receiving isoflavones at such high concentrations," Donovan said. "Formula is the sole source of nutrition for these infants for the first four to six months of life, when so many important organ systems are developing."

In the first study, Donovan treated intestinal cells in culture with genistein in the amount present in soy infant formula and found that the cells "basically stopped proliferating." However, actions seen in cells in culture may not be seen in infants, Donovan said.

In a second study, she fed one group of newborn piglets a cow's milk-based formula, while feeding other piglets formula supplemented with genistein at the level found in soy formula. Newborn pigs are an excellent model for human infants because they have a similar metabolism and physiology, she said.

In the piglets fed genistein, the number of proliferating cells in the intestine was 50 percent lower than piglets fed the cow's milk formula alone. Concentrations of genistein in the piglets' blood were similar to those of babies fed soy formula, so these data may be applicable to human infants, the researcher said.

No differences in the activities of digestive enzymes or uptake of nutrients were observed, which suggests that genistein had little effect on mature intestinal cells that were no longer proliferating.

Although these data are the first to show that genistein is bioactive in the neonatal intestine, Donovan said these results do not mean soy formulas should not be fed to babies. "Clinical data suggest that soy formulas are safe," she said, "but even though they appear to be safe, they may not be without effect."

So far, Donovan has studied genistein alone, but soy formulas contain other soy isoflavones that likely affect genistein's actions in the intestine. The researcher plans to study those interactions. "Soy isoflavones may have both positive and negative effects that need to be better understood," she said.

Donovan pointed to recent research that showed adding long-chain polyunsaturated fatty acids to infant formula improves brain and retinal development and even IQ scores. Recent research has also shown that adding nucleotides to baby formula causes babies to react better to vaccinations and make more antibodies, she said.

"And although that research showed differences that were measurable, the babies fed formula with added fatty acids or nucleotides appeared to grow the same as other babies do," she said. "So I don't think you can use growth as the sole parameter for normal development."

An-Chian Chen contributed to the cell-culture study. Other researchers contributing to the piglet study were An-Chian Chen, Mark A. Berhow, and Kelly A. Tappenden. Both studies were funded by the Illinois Council on Food and Agricultural Research (C-FAR) and the USDA.

