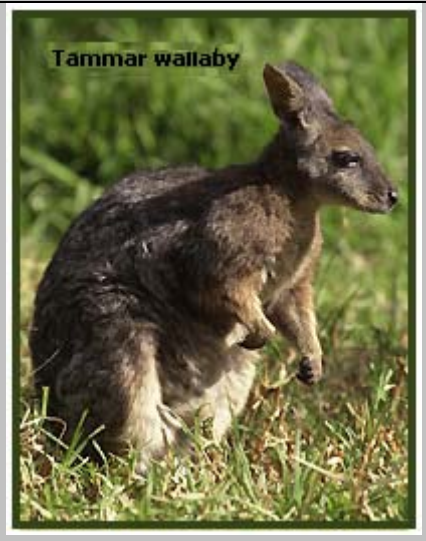
Mother knows best

Mother's milk turns out to be more than just the best food for baby, says S.Ananthanarayanan.

Lactation, it is found, is an extension of the period in the womb and mother's milk changes in content, as the infant matures. The discovery seems to further push away any reasons to prefer formula milk when breast feed is possible. Anna Petherick, a journalist in Buenos Aires, has brought together the current knowledge in the field in her review in the journal, ***Nature***.

Tammar Wallaby

A classic example of lactation playing a major role in development is in the case of ***Marcopus eugenii***, or ***Tammar Wallaby***, a small (half a meter) animal of the kangaroo family, found on off shore islands of southern and western Australia. The young wallaby is born just 28 days after conception and is barely a gram in weight, at birth. As soon as it is born, the joey crawls into its mother's pouch, attaches to a teat and is not weaned for another 9 to 10 months.



This is, in fact, a continuation of the development of the embryo and the quality of milk the joey gets is found to change almost every week! Just after birth, the milk is rich in colostrum, which provides the newborn its battery of antibodies to deal with infection. At 60 days, the milk contains ***asparagine***, an amino acid which is used by the nervous system. Asparagine is not an *essential* amino acid, in the sense that it can be synthesized by the body and does not have to found in the diet. Its presence in milk is hence considered to be timed with a stage of brain development, when the body needs an abundant supply.

Some weeks later, when hair follicles and nails begin to grow, the milk has to provide amino acids, like cystein and methionine, which contain sulphur. And all along, the level of calories being provided needs to rise, so that at the time the joey leaves the pouch, it is drinking milk four and a half times richer in energy than at the start.

Human mothers

That human milk is rich in colostrum, immediately after birth, is now getting known, although some midwives in India still prevent breast feed for the first few hours. But the colostrum-rich, 'first milk', which protects against infection immediately at birth, when the baby is the most vulnerable, is thought to provide long lasting immunities as well.

Apart from the special colostrum dose at birth, human milk does not vary as much as the wallaby's, because the signals for important stages of development, with resources, have already been passed on during gestation, through the placenta. Weaning is also comparatively early and the major constituents, fats, protein and carbohydrates stay largely at the same level. For all that, current research reveals that human milk, which has a negligible role in timing and providing for development, has constituents, which change with time, to perform other functions.

One of these is the family of carbohydrates called ***human milk oligosaccarides, or HMO***. Human milk is anyway less concentrated than that of other large animals and HMO is also not a source of food for infants. What then, is the role of about 100 such compounds that human mothers produce in their milk?

Gut bacteria

The particular HMOs, it is found, nourish or inhibit particular strains of bacteria in the infant's digestive system. "When a child is born its gut is rapidly populated by pathogenic bacteria," says Calito Lebrilla, analytical chemist at the Universtiy of California at Davis. "However as the child is fed human milk the population changes to beneficial species." For instance, ***Bifidobacterium infantis***, which is an agent that protects against diarrhoea, is able to thrive on HMOs. The word, ***oligo***, means 'few' and oligo carbohydrates, like the HMOs, have short chains of only a few simple sugars. B. infantis, which is adapted for HMOs, then finds ample food and dominates other bacteria in the infant's gut.

HMOs are also able to directly inhibit harmful bacteria and viruses. The molecular structure of HMOs blocks the binding sites of many harmful bacteria, so that they are not able to bind to parts of the intestine or other body cells. Human milk also delivers specific bacteria to the infant gut, to prevent different kinds of hostile attack. Several types of lactic acid bacteria present in the mother's intestines, which can secrete hydrogen peroxide and compounds called ***bacteriocins***, and inhibit harmful bacteria travel to the mammary glands and then to mother's milk.

The last decade has yielded much evidence of the positive benefits of breast feeding of infants. Earlier, the only benefit was thought to be the delivery of antibodies from the mother. Now, a crop of immunity regulating proteins has been identified, which could be participating in the development and control of the infant's own immune system. There is even some evidence that breast milk promotes gene expression in infant gut cells, or the efficacy of the cells' genetic store to create different proteins. Sharon Donovan, a

paediatric nutritionist in Illinois and Robert Chapkin, a biochemist in Texas, found that breast fed babies showed increased factors that control the growth of new blood vessels and wound repair,

Breast feed and IQ

An area strongly resisted by formula feed manufacturers is the claim that breast feed promotes IQ. Studies to establish such a conclusion need to eliminate several factors which could cloud the results. For instance, it is more affluent mothers who are likely to breast feed their children and such mothers are also more likely to talk with their children and expose them to cognitive challenges.

A study that is recognised is of 13,889 Belarusian children, about half of whose mothers were part of WHO's Baby-Friendly Hospital Initiative, and hence significantly more likely to have breast fed their children for the first 3 months. IQ tests and evaluation of reading and writing skills at the age of 6 showed "5.9 points higher IQ in children whose mothers had been part of the WHO intitiative".

The programme "found lots of health benefits in the first year of life," says Michael Kramer, an epidemiologist at McGill University in Montreal, "but over the longer term the only difference was cognitive ability." In a 2007 study, Duke University psychologist Avshalom Kapsi and colleagues searched through the Kyoto Encyclopaedia of Genes and Genomes (KEGG) for genes involved in arising of fatty acids linked to neural development. The search has revealed a variant of a gene called FADS2 which is associated with the IQ advantage of breast fed babies, and accounts for a great part of the 5.9 point IQ difference found in breast fed children.