

March 14-15th, 2015, Barcelona

Fact sheet #1

How mother's gut microbiota can impact the microbial composition of breast milk

Breast milk can provide the infant's gut with beneficial bacteria that induce protective effects against a number of conditions. Recent findings show that the mother's gut microbiota has an important impact upon the microbial composition of the milk and its health supporting qualities. This opens up promising avenues for the application of breast milk bacteria as beneficial microbes in the management of infectious and immune diseases in mothers and infants, said Dr. Esther Jiménez (Complutense University of Madrid / Spain) at the Gut Microbiota for Health World Summit that took place in Barcelona, March 14-15, 2015.

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For a long time breast milk was considered sterile. But subsequent studies have shown that it contains a large amount of bacteria, among them lactic acid bacteria and bifidobacteria. A baby consuming about 800 millilitres of milk per day ingests between a hundred thousand and ten million bacteria daily. This is actually

good news as many of these micro-organisms help to protect the baby against infections and foster the development of an efficient immune system. It has long been suggested that exposure of breastfed children to such a bacterial diversity decreases the risk of developing a number of conditions, among them diarrhoea, respiratory diseases and metabolic conditions. Part of the bacteria enter the milk through contact with the mother's skin and the suckling's mouth.

Pathway from gut to gland

But that cannot be the whole story because in addition to some commonalities there are also considerable differences between the composition of the skin microbiota and that of breast milk, as Dr. Jiménez pointed out: "In mother's milk samples we found bacterial species that are not present on the maternal breast¹. Moreover, bifidobacteria, which are part of the milk microbiota, are anaerobic. This alone makes skin or mouth a very unlikely environment for this kind of bacteria. Instead, these findings point to the maternal gut as the source of at least some of the breast milk bacteria." Although the precise mechanisms of this transfer inside the body have not been completely unveiled so far, several findings already suggest how it probably works. It



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seems that dendritic cells – among whose tasks is the detection of potentially harmful micro-organisms – serve as transport vehicles. These cells are able to pervade the intestinal wall – while leaving its barrier function intact –, take up non-pathogenic bacteria from inside the gut and feed them in the lymphatic and blood circulation through which they finally reach the milk producing mammary gland. Beside dendritic cells, macrophages (belonging to the white blood cells) might play a similar role. “Our findings and those of other research groups have gathered evidence that, firstly, there is a pathway linking the mother’s gut with the mammary gland during lactation period and that, secondly, dendritic and possibly other mononuclear cells serve as transport vehicles that carry these live intestinal bacteria via this pathway.”

Positive effects on the infant

Breast milk contains several kinds of bacteria that can serve as probiotics which means that they exert anti-infectious, anti-inflammatory, immunomodulatory and metabolic effects on the infant. Studies have paid particular attention to asthma and atopic dermatitis and it could be shown that breast milk bacteria can improve or even prevent these conditions. “What makes these microbes especially attractive as compared to other

bacteria is that they are of human origin and are well tolerated even by such particularly sensitive organisms as are those of infants. Breast milk bacteria are uniquely adapted to reside in the human gut and to interact with us from the time we are born”, said Dr. Jiménez.

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**Dr.
Esther Jiménez Quintana**

Another disease Dr. Jiménez and other scientists have looked into with regard to the effect of breast milk bacteria is mastitis. This condition affects up to one third of the lactating mothers. It is often resistant to antibiotic therapy and a main reason for mothers to cease breastfeeding. “We found that the intake of certain bacterial strains from breast milk – lactobacilli such as *L. salivarius*, *L. gasseri* and *L. fermentum* – can work as a probiotic for mastitis. Our studies showed that the condition of women who had ingested these bacteria over a period of at least three weeks had improved significantly, while that of the placebo groups remained mostly unchanged,” said Dr. Jiménez. The ingested probiotic bacteria colonize the mammary gland via the entero-mammary pathway and, once they have reached their destination, reduce the mastitis-causing bacteria (staphylococci and streptococci).

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Protecting children from HIV

According to Dr. Jiménez the probiotic potential of breastfeeding might also be used to better protect children from contracting HIV-1 (the most common AIDS-virus) from their infected mothers: “Recent *in vitro* investigations revealed that certain lactic acid bacterial strains obtained from human breast milk can inhibit HIV-1 infection by strengthening the infant’s mucosal protection against the virus.” As Dr. Jiménez points out, the underlying mechanisms have still to be fully explored but it is already clear that the interaction of bacteria such as *L. salivarius* with dendritic cells plays an important role in keeping the viral “enemy” away from the mucosa and thus reducing HIV infectivity. An additional point in favor of mother’s milk is the fact that the intestinal permeability decreases faster in breastfed children than in those given formula. This suggests that some components in breast milk accelerate the maturation of the gut barrier. By contrast, the introduction of potentially harmful food proteins or pathogens during bottle-feeding might cause the opposite effect, which makes it easier for the virus to overcome the barrier. This theory is supported by the fact that the early phases of HIV disease are accompanied by impairment of the gastrointestinal tract, which in turn is associated with changes of the gut microbiota composition. “These findings support the hypothesis that gastrointestinal tract alterations are a key factor in the development of HIV, and may explain why infants who are exclusively breastfed have a significantly lower risk of being HIV-infected than infants who are bottle-fed or mixed-fed,” explained Dr. Jiménez. “Findings like these open up a whole new horizon of potential treatments: The mother’s gut microbiota could be modulated by probiotics in order to improve the microbiota of the mammary gland and increase the health supporting quality of the breast milk. This in turn would have a direct effect on infant health.”

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**Dr.
Esther Jimenez Quintana**

Reference:

Fernández, Leónides et al. (2013): The human milk microbiota: Origin and potential roles in health and disease. *Pharmacological Research* 69 (2013) 1– 10
<http://dx.doi.org/10.1016/j.phrs.2012.09.001>

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