

INSIGHTS FOR  
HEALTHCARE  
PROFESSIONALS

# the feed

## Preventing Mastitis for a Better Breastfeeding Experience

—  
Breaking down the barriers  
and **maximizing the  
benefits of breastfeeding**

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**Breastmilk microbiota  
pack:** A mighty punch  
when it comes to  
mother-infant health

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Under the spotlight:  
**A closer look at  
mastitis**

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**Prevention is better  
than cure** when it comes  
to mastitis management

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**Probiotics:** An exciting  
and powerful strategy in  
**mastitis prevention**



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# Breaking down the barriers and maximizing the benefits of breastfeeding



**Ms. Moenie van der Kleyn MPH**

Ms. van der Kleyn qualified as a midwife in 1990 and is also an IBCLC lactation consultant. She has a special interest in breastfeeding sciences. Currently, the Director of the Midwifery Institute at FH Joanneum University, Austria; Ms. van der Kleyn has helped publish various research papers, including a number of current guidelines in the field of gynaecology and obstetrics.

## Breastmilk is the best nutrition source for infants\*<sup>1</sup>

Breastfeeding is the best possible way for mothers to nourish their infants in early life since breastmilk is considered the optimal infant nutrition source during this time.<sup>1</sup> Breastmilk is a dynamic, 'living' liquid, which contains nutritional and bioactive compounds including proteins, lipids, oligosaccharides, bacteria and their metabolites, as well as vitamins, minerals, immune cells, and hormones.<sup>2-4</sup> Breastmilk is specifically adapted – and its compounds uniquely balanced – to fully support the healthy growth and development of infants during their first six months of life.<sup>3-5</sup>

that produces the harmonious melody and not just individual instruments themselves. Similarly, it is the interplay between all of its compounds that results in the miracle that is breastmilk!

### Benefits for mother and child

The process of breastfeeding, and indeed, the composition of breastmilk itself, provide many short- and long-term benefits for optimal infant growth and development.<sup>3,5-9</sup> These may include protection against infections, illnesses, allergies, asthma, and obesity.<sup>3,5-9</sup> Besides helping the mother bond with her infant, breastfeeding can help the mother's post-partum weight loss and emotional health. Also, the mother's risk of reproductive cancers may be reduced and her metabolic/cardiovascular health improved.<sup>3,7,10</sup>

“  
*Exclusive breastfeeding is a cornerstone of child survival and child health because it provides essential, irreplaceable nutrition for a child's growth and development*

World Health Organization (2014)<sup>6</sup>

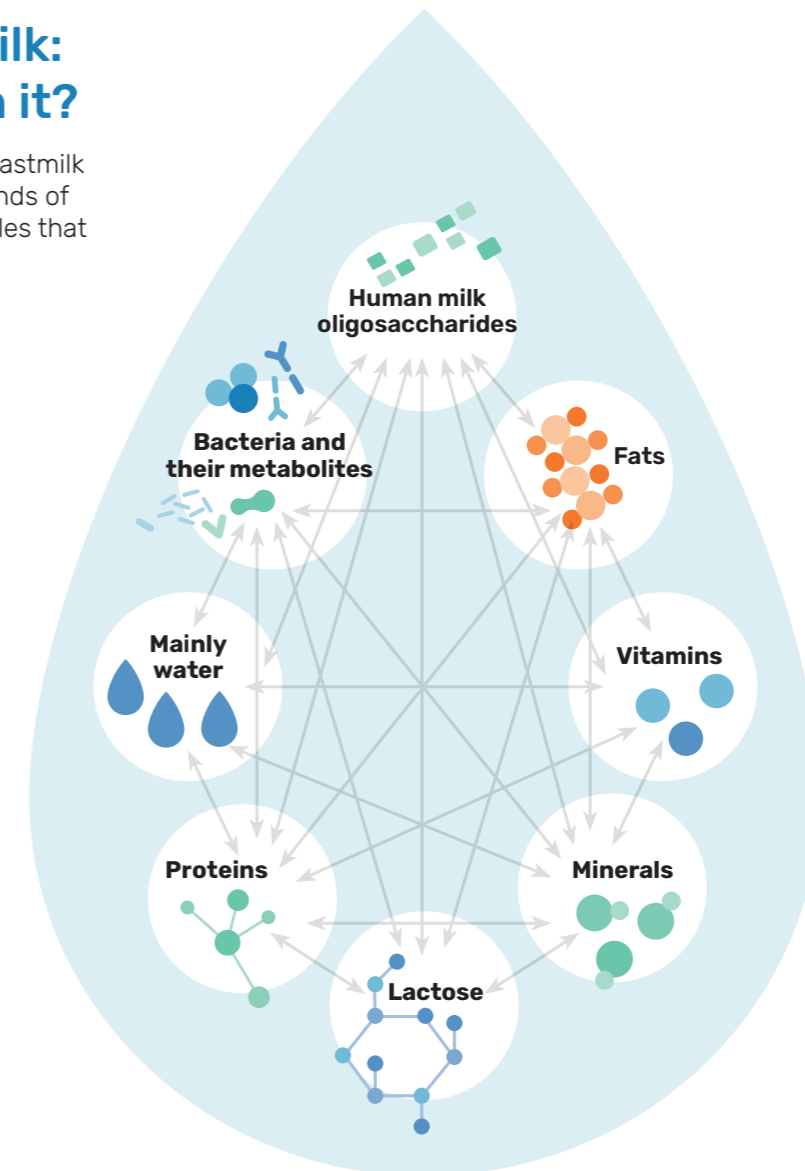
It is, in fact, the complex interplay of all its compounds that confer the unique benefits of breastmilk. To make this easier to visualize, it might help to imagine breastmilk as a symphony orchestra with each of the compounds acting as one of its instruments. In the orchestra, it is the interaction between the various instruments

**In recognizing the importance of breastfeeding, the WHO recommends exclusive breastfeeding for the first 6 months of age and continued breastfeeding for up to 2 years and beyond, combined with the safe introduction of certain complementary foods<sup>11</sup>**



## Breastmilk: What's in it?

Each drop of breastmilk contains thousands of different molecules that work in unison.



### Despite its benefits, breastfeeding rates across the world are suboptimal

Only 38% of infants (0–6 months) are exclusively breastfed – a figure which has remained largely unchanged over the past two decades.<sup>6,12</sup> There may be various causes for these suboptimal rates including work/family circumstances, infant latching problems, and medical reasons.<sup>13</sup>

One such medical reason is mastitis, or inflammation of the mammary gland tissue.<sup>14</sup> Some mothers may stop breastfeeding due to the painful symptoms of this medical condition.<sup>14</sup> Mastitis can occur with or without infection and distinguishing between both these types is important when managing this condition.<sup>14,15</sup> Either way, overcoming mastitis will likely support mothers on their breastfeeding journey.<sup>16</sup>

“  
*Breastfeeding is not always easy. Empowering mothers to choose the optimal solutions themselves, boosts longer breastfeeding duration, even after mastitis.*

Ms. van der Kleyn

\*up to the first 12 months of life.

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# Breastmilk microbiota pack:

## A mighty punch when it comes to mother-infant health



### Dr. Maria Carmen Collado

Dr. Collado is a researcher at Dept. Biotechnology, Institute of Agrochemistry and Food Technology (IATA) of the Spanish National Research Council (CSIC) located in Valencia, Spain. Dr. Collado's research interests are focused on probiotics, microbiota and health and nutrition. Her current work includes basic and applied research on molecular analysis and evaluation of health effects of beneficial bacteria and probiotics, the microbial-host interactions, microbiome and its role in human health and diseases and also, the influence of diet (lactation) and other perinatal factors.

### Full of life: breastmilk is very much a living liquid

Until quite recently, breastmilk was thought to be sterile but it is actually a living liquid with a highly diverse bacterial composition or microbiota.<sup>1,2</sup> In fact, bacteria (typically 10<sup>2</sup>-10<sup>4</sup> bacterial cells/ml) in breastmilk was first shown in the early 2000s.<sup>1,2</sup> The most isolated bacterial strains belong to *Staphylococcus*, *Streptococcus* genus followed by *Enterococcus* *Lactobacillus* and *Bifidobacterium*.<sup>3-5</sup>

However, the microbiota in a mother's breastmilk will vary according to factors such as her diet and antibiotic use as well as her demographic and health characteristics and geographical circumstances.<sup>6,7</sup> That said, certain bacteria (such as *Streptococcus* and *Staphylococcus*) may

always be the predominant strains in breastmilk regardless of such factors.<sup>8</sup>

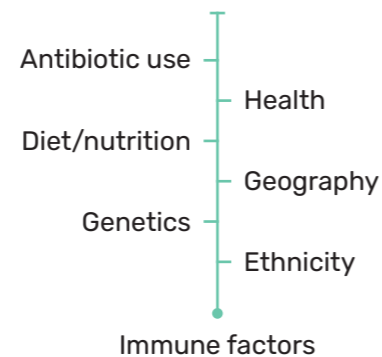
### How did breastmilk come to have microbiota?

There is no certain answer to this question at the moment though two prominent theories exist. One specifies an "entero-mammary pathway" whereby non-pathogenic bacteria travel from the intestinal lumen into the mammary gland and subsequently, into breastmilk.<sup>9-11</sup> Meanwhile, another theory suggests that the bacteria arise from the reverse flow of breastmilk from the infant's mouth back into the mammary duct during breastfeeding.<sup>11-13</sup> Either way, the precise origin of microbiota in breastmilk needs further research.

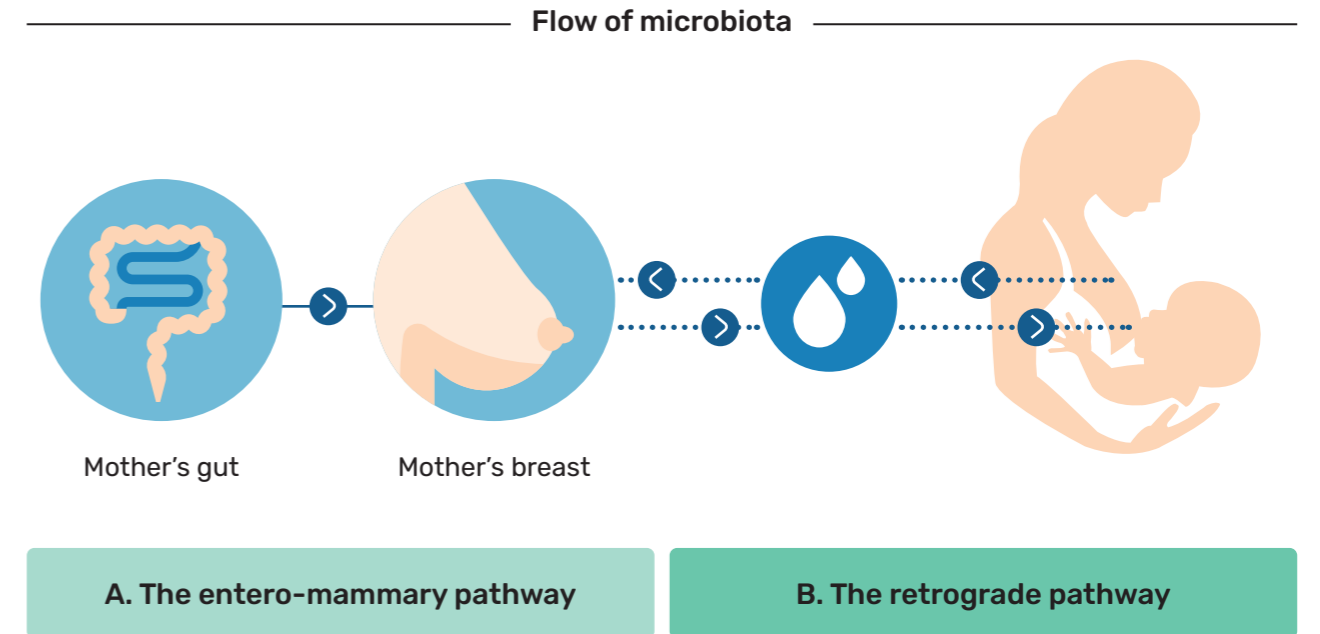
The microbiota composition of breastmilk is unique to each mother and reflects her personal factors<sup>6,7</sup>



### Many factors may affect the composition of the mother's breastmilk microbiota<sup>6,7</sup>



### Breastmilk may have come to contain microbiota as a result of various mother and/or infant biological processes<sup>10-13</sup>



### A delicate balance...

The composition of breastmilk microbiota is extremely important.<sup>10,11,14</sup> The microbiota may be behind the mother-infant health benefits of breastmilk and this is currently an area of research.<sup>11,15</sup> In particular, the benefits from lactic acid bacteria (*Lactobacillus*) found in breastmilk may include reduced infection incidence/severity and improved intestinal barrier function.<sup>1,12,16</sup> Lactic acid bacteria may also offer protection against allergies, intolerances, and autoimmune diseases.<sup>1,12,15</sup>

*Beyond its nutritional aspects, human milk contains several bioactive compounds, such as microbes, oligosaccharides, and other substances, which are involved in host-microbe interactions and have a key role in infant health*

Gomez-Gallego C, et al. 2016<sup>16</sup>

The microbiota-related benefits of breastmilk depend on a balanced composition of healthy and potentially (if they overgrow) harmful bacteria.<sup>15</sup>

### Mastitis: A loss of balance?

An imbalance or dysbiosis of breastmilk microbiota has been linked to the onset of mastitis.<sup>15</sup> There is an overgrowth of potentially harmful bacteria (e.g. *Staphylococcus*, *Streptococcus*, *Corynebacterium*) coupled with a reduction in beneficial commensal bacteria (*Lactococcus* and *Lactobacillus*) in mastitis.<sup>12</sup>

A balanced microbiota may help prevent mastitis and thereby promote breastfeeding and mother-infant health

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# Under the spotlight: A closer look at mastitis



**Prof. Juan Miguel Rodríguez Gómez**

Prof. Rodríguez from the Nutrition and Food Science Department of the Complutense University of Madrid, Spain, is a highly published author and experienced international speaker on topics including breast health and microbiota. In 2001, Prof. Rodríguez and colleagues discovered that human milk contained bacteria in physiological conditions, some of which derived from the maternal intestine via an endogenous route.

## Mastitis is a major reason mothers stop breastfeeding but what do we know about this condition?

### Defining mastitis

Mastitis can be a painful and debilitating condition for mothers which, if untreated, can lead to some stopping breastfeeding prematurely.<sup>1-3</sup>

Mastitis is defined by the WHO as “an inflammatory condition of the breast, which may or may not be accompanied by infection.”<sup>4</sup> A generally accepted way to diagnose this condition is through a combination of clinical features including flu-like symptoms and breast pain as well as signs of inflammation, erythema, fever, and engorgement.<sup>5</sup> If the symptoms of mastitis persist beyond 24 hours, it is termed infectious mastitis. There are two main types of mastitis: acute mastitis, where there is acute breast inflammation with local and systemic flu-like symptoms and subacute mastitis, where breast inflammation is accompanied by other local, but not systemic, symptoms.<sup>6</sup> A third type, subclinical mastitis, has been described too, in which inflammatory changes, including pain are absent.<sup>7</sup>

### Mastitis is common among breastfeeding women

On average, 20–25% of women are at risk of developing mastitis during the lactation period though estimates of incidence range from 10–33% (accurate estimates are difficult since the definition of mastitis and rates of self-reporting can vary).<sup>2,4,9,10</sup> While most cases of mastitis occur in the first 6 weeks, it can occur at any time during lactation.<sup>11</sup>

The most common cause of mastitis is milk stagnation; often from untreated breast engorgement.<sup>4</sup> Another, cause may be an unbalanced breast microbiota.<sup>3,7,12</sup> Risk factors for mastitis include suboptimal breast attachment, C-section delivery, antibiotic use, a history of infections/mastitis and nipple damage.<sup>10,13,14</sup>

“Despite the health benefits of breastfeeding, initiation and duration rates continue to fall short of international guidelines. Many factors influence a woman’s decision to wean; the main reason cited for weaning is associated with lactation complications, such as mastitis”

Crepinsek MA, et al. 2008<sup>9</sup>

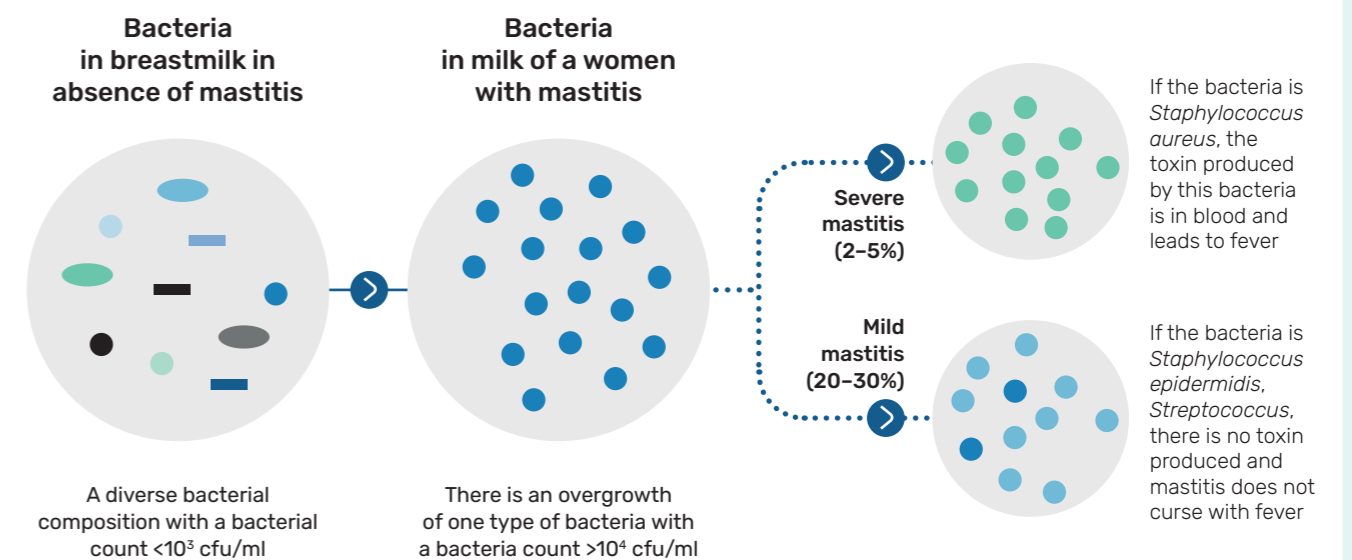
### Tipping the microbiota balance

There is dysbiosis (imbalance) and a lower diversity of microbiota in the breastmilk of mothers with infectious mastitis compared to mothers without. The breastmilk

of mothers without mastitis contains certain bacteria or ‘opportunistic pathogens’ (such as *staphylococci*, *streptococci* and/or *corynebacteria*) which can become invasive, pathogenic and outgrow in numbers in some circumstances.<sup>2,15-17</sup> For example, staphylococcus, in particular

*S.aureus*, – which is inhibited by commensal bacterial such as *Staph epidermidis* and *Strep. salivarius* – is one of the main pathogens which causes acute mastitis. Significantly higher amounts of *S.aureus* have been reported in the milk of women with acute mastitis than those without.<sup>2,16</sup>

## Breastmilk microbiota in mothers without, and with mastitis



### A lot hinges on the prevention of mastitis

Breastfeeding can substantially benefit both the mother and infant’s health.<sup>2</sup> These benefits are recognized by the WHO through their commitment to increasing breastfeeding rates worldwide.<sup>19</sup> This makes the prevention of barriers to breastfeeding vital – and mastitis prevention a public health issue.<sup>18,20</sup> The good news is that, although challenging, mastitis is largely preventable and new strategies are emerging.<sup>4,19</sup>

“Lactational mastitis constitutes one of the main causes of undesired weaning, depriving the mother–infant pair from the benefits of breastfeeding; therefore, this condition should be considered a relevant public health issue”

Marín M, et al. 2017<sup>18</sup>

**References:** 1. Scott JA, et al. Int Breastfeed J. 2008;3:21. 2. Patel SH, et al. Sci Rep. 2017;7(1):7804. 3. Fernández L, et al. Pharmacol Res. 2013;69(1):1-10. 4. WHO (2000). WHO; available at [https://www.who.int/maternal\\_child\\_adolescent/documents/fch\\_cah\\_00\\_13/en/](https://www.who.int/maternal_child_adolescent/documents/fch_cah_00_13/en/). 5. Cusack L, Brennan M. Aust Fam Physician. 2011;40(12):976-9. 6. Fernández L, et al. Clin Infect Dis. 2016;62(5):568-73. 7. Contreras GA, et al. J Mammary Gland Biol Neoplasia. 2011;16(4):339-56. 8. Crepinsek MA, et al. Cochrane Database Syst Rev. 2010;(8):CD007239. 9. Michie C, et al. Archives of Disease in Childhood. 2003;88(9):818-821. 10. Wilson E, et al. J Hum Lact. 2020;36(4):673-686. 11. Amir LH. Breastfeed Med. 2014;9(5):239-43. 12. Beghetti I, et al. Nutrients. 2019;11(12):2944. 13. Walker M. Clinical Lactation. 2018;9(3):130-136. 14. Khanal V, et al. Breastfeed Med. 2015;10(10):481-487. 15. Ojo-Okunola A, et al. Nutrients. 2018;10(11). pii: E1643. 16. Heikkilä MP, Saris PEJ. J Appl Microbiol. 2003;95(3):471-78. 17. Jeurink PV, et al. Benef Microbes. 2013;4(1):17-30. 18. Marín M, et al. Front Microbiol. 2017;8:1258. 19. WHO, UNICEF (2014). WHO, UNICEF; available at [https://www.who.int/nutrition/publications/globaltargets2025\\_policybrief\\_breastfeeding/en/](https://www.who.int/nutrition/publications/globaltargets2025_policybrief_breastfeeding/en/). 20. Mediano P, et al. BMC Pregnancy Childbirth. 2014;14:195. 21. Hurtado JA, et al. Breastfeed Med. 2017;12(4):202-209.

# Prevention is better than cure when it comes to mastitis management



**Prof. Michael Abou-Dakn**  
 Prof. Abou-Dakn heads the Gynaecology and Obstetrics department, in Germany at St. Joseph Hospital, Berlin. He specialises in breast diseases during breastfeeding, with lactation medicine being a subject area of his research and teaching. A prolific author of over 50 publications, Prof. Abou-Dakn has held membership at numerous committees and boards including the National Breastfeeding Commission.

## One step ahead: How can mastitis be prevented?

### The many advantages of mastitis prevention

The prevention of mastitis could greatly help realise the WHO target of increasing exclusive breastfeeding rates to at least 50% around the world by 2025.<sup>1</sup> Also, the prevention of mastitis is clearly preferable to treatment of this condition, which often involves the use of antibiotics.<sup>2-5</sup> Antibiotics are a logical treatment for mastitis since *Staphylococcus aureus* is one of the major etiological agents of infectious mastitis and their use can prevent complications but their overuse may result in the development of antibiotic resistance. Added to this, there are concerns about the possible exposure of the infant to these medications during breastfeeding.<sup>2,4-6</sup> Preventing mastitis would also help with the avoidance of serious complications such as breast abscesses which can develop in up to 3–11% of mothers with mastitis.<sup>4</sup>

### Education and counselling go a long way towards preventing mastitis

Many of the risk factors for mastitis are modifiable, for example, linked to the mother's breastfeeding practices.<sup>3,7</sup> Therefore, education and counselling to increase maternal awareness of such risk

factors may reduce the incidence of mastitis.<sup>7</sup> Effective management of breast fullness and breast engorgement is a particularly important step.<sup>3,8</sup> A mother should manually express her breasts, if they are too full and an infant cannot relieve the fullness. Also, feeds should not be restricted and proper attachment to the breast is important.<sup>3,8</sup> Besides managing breast fullness, other recommendations for the mother from the Academy of Breastfeeding Medicine (ABM; 2014) guidelines include the need for adequate rest (as fatigue is a precursor of mastitis) and for good hand and breast pump hygiene (to help prevent *S. aureus* infection).<sup>9</sup> Mothers should also be advised on breast care and mastitis sign recognition so that they can seek professional help promptly when needed.<sup>3,8</sup>

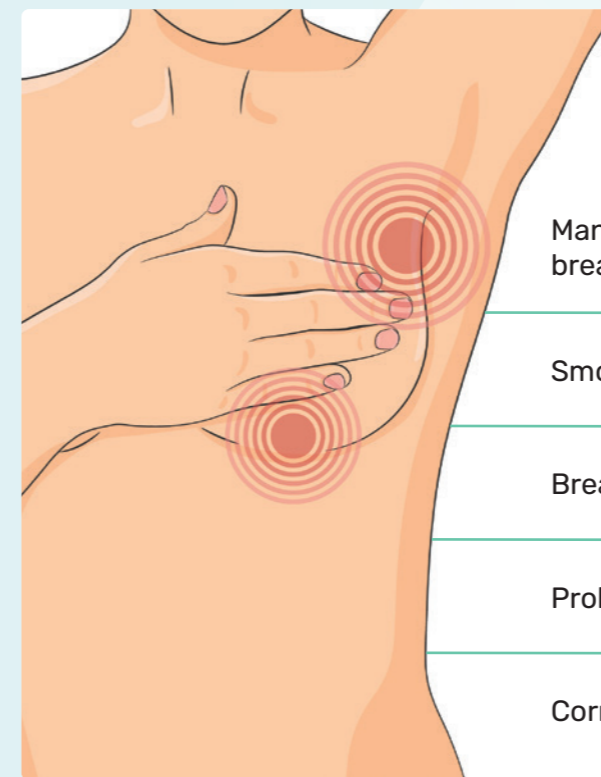
While healthcare professionals are well placed to support best breastfeeding practices and mastitis prevention, there may be room for improvement regarding their understanding of mastitis as a whole, including its management. A published study titled *"Health professionals' advice for breastfeeding problems: Not good enough!"* suggested that some professionals provided inappropriate advice or medications to their patients for this condition.<sup>9</sup>

## New strategies may also be important in mastitis prevention

While education and counselling are the foundation of successful mastitis prevention, other strategies may too have a significant role.<sup>3,8,10</sup> Recent evidence points to the use of probiotics as a promising, complementary strategy.<sup>10</sup> Probiotics are defined as live microorganisms that, when administered in adequate amounts, confer a health benefit on the host.<sup>11</sup> Several clinical trials have demonstrated positive outcomes with respect to the use of these agents in mastitis prevention, although further research is needed.<sup>12-14</sup>

*A number of studies have demonstrated that administration of probiotic bacteria, particularly the lactobacilli strain isolated from human milk, has the potential to prevent and treat maternal breast infections caused by Staphylococcus aureus; the key mechanism for this probiotic treatment of mastitis being related to the stimulation of the host intra-mammary immune system*

Bond DM, et al. 2017<sup>15</sup>



Management  
breast fullness / engorgement

Smoking cessation

Breast pump avoidance / hygiene

Probiotics

Correct infant latching

Healthcare professionals can play a key role in mastitis prevention



**References:** 1. WHO, UNICEF (2014). WHO, UNICEF; available at [https://www.who.int/nutrition/publications/globaltargets2025\\_policybrief\\_breastfeeding/en/](https://www.who.int/nutrition/publications/globaltargets2025_policybrief_breastfeeding/en/). 2. Jahanfar S, et al. Cochrane Database Syst Rev. 2013;(2):CD005458. 3. WHO (2000); available at [https://www.who.int/maternal\\_child\\_adolescent/documents/fch\\_cah\\_00\\_13/en/](https://www.who.int/maternal_child_adolescent/documents/fch_cah_00_13/en/). 4. Boakes E, et al. Eur J Breast Health. 2018;14(3):136–143. 5. van Wattum JJ, et al. Basic Clin Pharmacol Toxicol. 2019;124(1):5–17. 6. Marin M, et al. Front Microbiol. 2017;8:1258. 7. Blackmon MM, et al. [Updated 2020 Jul 21]. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020. Available at <https://www.ncbi.nlm.nih.gov/books/NBK557782/>. 8. Amir LH, Academy of Breastfeeding Medicine Protocol Committee. Breastfeed Med. 2014;9(5):239–43. 9. Amir LH, Ingram J. Int Breastfeed J. 2008;3:22. 10. Hurtado JA, et al. Breastfeed Med. 2017;12(4):202–209. 11. ISAPP (2019). ISAPP; available at <https://isappscience.org/for-scientists/resources/probiotics/>. 12. Barker M, et al. JBI Database System Rev Implement Rep. 2019 Oct 24. doi: 10.1124/JBISRIIR-D-19-00190. Epub ahead of print. 13. Arroyo R, et al. Clin Infect Dis. 2010;50:1551–58. 14. Rodriguez JM, et al. In: World of Microbiome: Pregnancy, Birth & Infancy Conference; October 31 – November 02, 2019; Milan, Italy. Abstract 055. 15. Bond DM, et al. BMC Pregnancy Childbirth. 2017;17(1):148.

# Probiotics: An exciting and powerful strategy in mastitis prevention



## Dr. Esther Jiménez Quintana

An associate professor at the Complutense University, Spain, Dr Jiménez, PhD, has over 10 years of research and development experience in the field of probiotics for human health. In addition to being an experienced speaker on the topic, Dr. Jiménez has co-authored over 50 articles, and successfully filed a number of probiotic patents.

## Evidence supporting the role of probiotics in mastitis prevention is growing...

### A fresh look at mastitis

Mastitis is usually characterized by a dysbiosis of the lactating breast microbiota.<sup>1,2</sup> During mastitis, 'beneficial' bacteria (such as *Lactococcus* and *Lactobacillus*) levels in the breastmilk are reduced while potentially harmful bacteria (such as *Staphylococcus* and *Streptococcus*) are increased.<sup>3</sup>

“While mastitis previously was considered the consequence of a bacterial infection, new evidence suggests that breast health is instead determined by a balance between different microbiota in the breast tissue, as well as by the state of the host's immune system

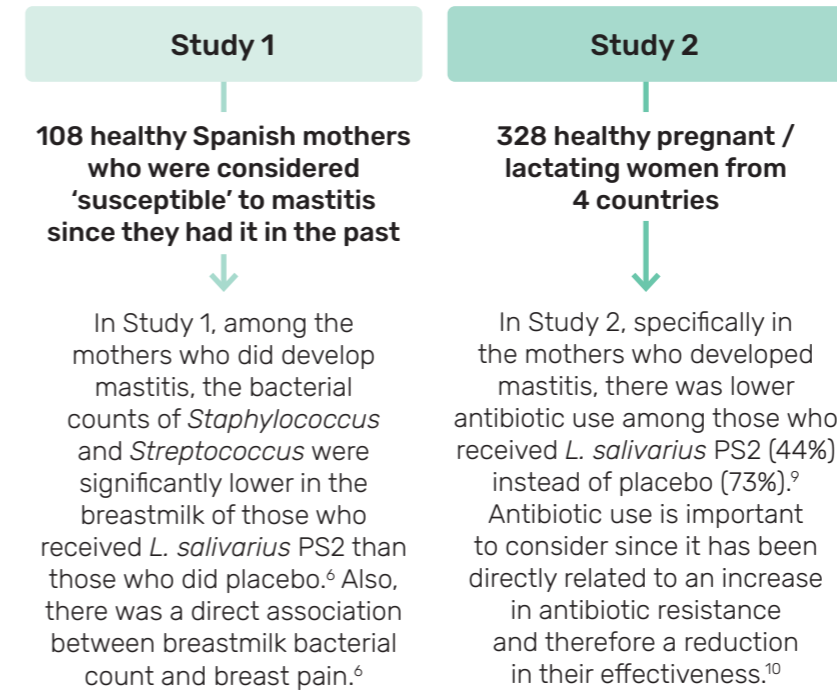
Karlsson S, et al. 2020<sup>1</sup>

### Targeting the breast microbiota: Probiotics may play an important role in mastitis prevention

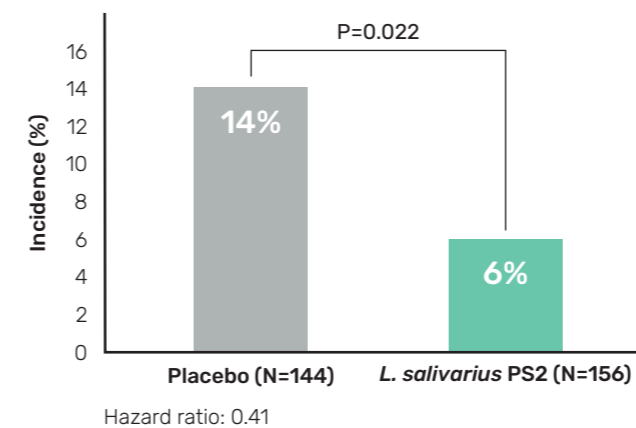
Probiotics are live microorganisms that, when administered in adequate amounts, confer a health benefit on the host.<sup>4</sup> They can be thought of as 'beneficial' microbiota. Probiotics may prevent mastitis, possibly by restoring the breast's microbiota balance.<sup>1,5,6</sup> Other mechanisms by which probiotics may work include through competitive exclusion of harmful bacteria, the production of antimicrobials or by normalization of breast tissue permeability. Their exact mechanism though is not yet known.<sup>1,7</sup> Evidence shows that the administration of certain probiotics to breastfeeding women with infectious mastitis can reduce breast pain, the recurrence of breast symptoms as well as restore the microbial imbalance of breastmilk.<sup>5</sup>

## One probiotic: Two studies

***Lactobacillus salivarius* PS2** is a strain isolated from breastmilk which has antimicrobial and anti-inflammatory properties. This protective probiotic has been shown to reduce staphylococcal bacteria counts in the breastmilk of women with mastitis.<sup>6,8</sup> Two clinical studies have so far, examined the ability of *L. salivarius* PS2 (versus placebo) to prevent mastitis when taken orally, by healthy mothers during late pregnancy and/or early lactation.<sup>6,9</sup>



### Mothers receiving *L. salivarius* PS2 were 59% less likely to develop mastitis in Study 2<sup>9</sup>



Adapted from: Fernández L, et al. 2016 and Jiménez E, et al. 2020.<sup>6,9</sup>

In both studies, the proportion of mothers who developed mastitis was significantly lower in the group that received *L. salivarius* PS2 than that receiving placebo: (Study 1: 25% vs. 7% [P<0.01]; Study 2: 6% vs. 14% [P=0.022]). There were no safety concerns in either study.<sup>6,9</sup>

## Putting these findings into context

Attention on probiotics has increased over the last two decades due to expanding scientific evidence regarding their health benefits, including in mastitis.<sup>7,11,12</sup> Overall, the two studies here suggest that *L. salivarius* PS2 may be a safe, natural and effective strategy in preventing mastitis and reducing its painful symptoms in pregnant or lactating women (with or without previous mastitis).<sup>6,9</sup> The use of probiotics for mastitis prevention would have a positive impact on mother-infant health while also reducing the burden of antibiotic use. However, further research – including large-scale studies such as the ones here – needs to be done to fully understand their role.<sup>11</sup>

“The studies performed with *L. salivarius* PS2 provide scientific evidence for its use in helping women to prevent mastitis

Dr. Jiménez

<sup>6,9</sup>In both studies, the mothers were either given a daily sachet of (*L. salivarius* PS2) or a placebo until at least delivery, without knowing which sachet they received.

**References:** 1. Karlsson S, et al. Eur J Nutr. 2020;59(5):2219–2228 2. Fernández L, et al. Pharmacol Res. 2013;69(1):1–10. 3. Ojo-Okunola A, et al. Nutrients. 2018;10(11). pii: E16435. 4. ISAPP (2019). ISAPP; available at <https://isappscience.org/for-scientists/resources/probiotics/>. 5. Arroyo R, et al. Clin Infect Dis. 2010;50:1551–58. 6. Fernández L, et al. Clin Infect Dis. 2016;62(5):568–73. 7. Kechagia M, et al. ISRN Nutr. 2013;2013:481651. 8. Rodríguez JM, et al. In: World of Microbiome: Pregnancy, Birth & Infancy Conference; October 31 – November 02, 2019; Milan, Italy. Abstract 055. 9. Jiménez E, et al. (Article in Press). 10. Marín M, et al. Front Microbiol. 2017;8:1258. 11. Barker M, et al. Women Birth. 2020;S1871–5192(19)30847–9. (online ahead of print). 12. Hurtado JA, et al. Breastfeed Med. 2017;12(4):202–209.



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