

ABSTRACTS L-Vag

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Role of Lactobacilli and Lactoferrin in the Mucosal Cervicovaginal Defense.

[Valenti P¹](#), [Rosa L¹](#), [Capobianco D¹](#), [Lepanto MS¹](#), [Schiavi E¹](#), [Cutone A¹](#), [Paesano R²](#), [Mastromarino P¹](#).

The innate defense system of the female mucosal genital tract involves a close and complex interaction among the healthy vaginal microbiota, different cells, and various proteins that protect the host from pathogens. Vaginal lactobacilli and lactoferrin represent two essential actors in the vaginal environment. Lactobacilli represent the dominant bacterial species able to prevent facultative and obligate anaerobes outnumber in vaginal microbiota maintaining healthy microbial homeostasis. Several mechanisms underlie the protection exerted by lactobacilli: competition for nutrients and tissue adherence, reduction of the vaginal pH, modulation of immunity, and production of bioactive compounds. Among bioactive factors of cervicovaginal mucosa, lactoferrin, an iron-binding cationic glycoprotein, is a multifunctional glycoprotein with antibacterial, antifungal, antiviral, and antiparasitic activities, recently emerging as an important modulator of inflammation. Lactobacilli and lactoferrin are largely under the influence of female hormones and of paracrine production of various cytokines. Lactoferrin is strongly increased in lower genital tract mucosal fluid of women affected by *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, and *Trichomonas vaginalis* infections promoting both innate and adaptive immune responses. In vaginal dysbiosis characterized by low amounts of vaginal lactobacilli and increased levels of endogenous anaerobic bacteria, the increase in lactoferrin could act as an immune modulator assuming the role normally played by the healthy microbiota in vaginal mucosa. Then lactoferrin and lactobacilli may be considered as biomarkers of altered microbial homeostasis at vaginal level. Considering the shortage of effective treatments to counteract recurrent and/or antibiotic-resistant bacterial infections, the intravaginal administration of lactobacilli and lactoferrin could be a novel efficient therapeutic strategy and a valuable tool to restore mucosal immune homeostasis.

KEYWORDS:

cervicovaginal defense; inflammation; lactobacilli; lactoferrin; vaginal homeostasis

[Biochem Cell Biol.](#) 2017 Feb;95(1):31-33. doi: 10.1139/bcb-2016-0051. Epub 2016 Aug 17.

Effects of lactoferrin in 6 patients with refractory bacterial vaginosis.

[Otsuki K¹](#), [Imai N²](#).

We previously reported that lactoferrin (LF) could be effective for preventing preterm delivery and intrauterine infections, based on data derived from mice and rabbits. Here we describe 6 women with a history of multiple pregnancy losses or preterm delivery and refractory bacterial vaginosis, who received prebiotic LF therapy and delivered an infant normally. Five of the women were pregnant and one was not at the time of this study. The Ethics Committee at Showa University Hospital and Showa University Koto Toyosu Hospital approved the therapeutic protocol. Vaginal suppositories and oral prebiotic LF were administered to patients who were refractory to conventional treatment for vaginosis and had a history of late miscarriages and very early preterm delivery due to refractory vaginitis and chorioamnionitis. LF significantly improved the vaginal bacterial flora. Lactobacillus, which was detectable in the vaginas of all patients after one month of LF therapy, gradually became dominant. The findings from these 6 patients suggest that administering LF to humans could help prevent refractory vaginitis, cervical inflammation, and preterm delivery.

KEYWORDS:

Lactobacillus; accouchement prématuré; cervical inflammation; infection intra-utérine; inflammation du col utérin; intrauterine infection; preterm delivery

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[Mediators Inflamm.](#) 2016;2016:3648719. Epub 2016 Oct 31.

Vaginal Lactoferrin Modulates PGE2, MMP-9, MMP-2, and TIMP-1 Amniotic Fluid Concentrations.

[Trentini A¹](#), [Maritati M²](#), [Cervellati C¹](#), [Manfrinato MC¹](#), [Gonelli A³](#), [Volta CA⁴](#), [Vesce F²](#), [Greco P⁴](#), [Dallochio F¹](#), [Bellini T¹](#), [Contini C²](#).

Inflammation plays an important role in pregnancy, and cytokine and matrix metalloproteases (MMPs) imbalance has been associated with premature rupture of membranes and increased risk of preterm delivery. Previous studies have demonstrated that lactoferrin (LF), an iron-binding protein with anti-inflammatory properties, is able to decrease amniotic fluid (AF) levels of IL-6. Therefore, we aimed to evaluate the effect of vaginal LF administration on amniotic fluid PGE2 level and MMP-TIMP system in women undergoing genetic amniocentesis. One hundred and eleven women were randomly divided into controls (n = 57) or treated with LF 4 hours before amniocentesis (n = 54). Amniotic fluid PGE2, active MMP-9 and MMP-2, and TIMP-1 and TIMP-2 concentrations were determined by commercially available assays and the values were normalized by AF creatinine concentration. PGE2, active MMP-9, and its inhibitor TIMP-1 were lower in LF-treated group than in controls (p < 0.01, p < 0.005, and p < 0.001, resp.). Conversely, active MMP-2 (p < 0.0001) and MMP-2/TIMP-2 molar ratio (p < 0.001) were increased, whilst TIMP-2 was unchanged. Our data suggest that LF administration is able to modulate the inflammatory response following amniocentesis, which may counteract cytokine and prostanoid imbalance that leads to abortion. This trial is registered with Clinical Trial number [NCT02695563](#).

Bacterial biota of women with bacterial vaginosis treated with lactoferrin: an open prospective randomized trial.

[Pino A¹](#), [Giunta G²](#), [Randazzo CL¹](#), [Caruso S²](#), [Caggia C¹](#), [Cianci A²](#).

Background: Bacterial vaginosis is the most frequent condition associated to the vaginal microbiota imbalance, affecting about the 40-50% of women in the world. Even if antibiotics are effective for bacterial vaginosis treatment a long-term recurrence rates, higher than 70%, is recorded. Lactoferrin is an iron-binding glycoprotein with bacteriostatic and bactericidal properties. It owns the ability to protect the host against infection, by binding and regulating the iron needed for the bacterial proliferation. **Objective:** The present study was an open prospective randomized trial (registration no. SHI-EVE-2014.01) aimed at characterizing the bacterial biota of women affected by bacterial vaginosis (BV) and assessing the effects of two different lactoferrin concentrations (100 mg and 200 mg vaginal pessaries) on the composition and dynamics of the vaginal bacterial biota. **Design:** Sixty women with BV were recruited and randomized into two groups to receive lactoferrin pessaries for 10 days. Clinical evaluation was based on Amsel criteria and Nugent scores. Culture-dependent methods and Ion Torrent PGM sequencing of the 16S rRNA gene were applied to study in depth the overall structure of the vaginal bacterial biota and its dynamics during the treatment. **Results:** Vaginal lactoferrin administration modified the vaginal microbiota composition in patients with BV. During treatment, both 100 mg and 200 mg lactoferrin vaginal pessaries significantly decreased the occurrence of bacteria associated with BV, such as *Gardnerella*, *Prevotella*, and *Lachnospira*, and increased the occurrence of *Lactobacillus* species. The bacterial biota balance was maintained up to 2 weeks after treatment only in women treated with 200 mg lactoferrin pessaries. **Conclusions:** This study indicates that lactoferrin could be proposed as an alternative therapeutic approach for BV. Our data showed, for the first time, the dominance of *Lactobacillus helveticus* species during and after vaginal lactoferrin treatment.

KEYWORDS:

16S rDNA; Ion Torrent; *L. helveticus*; *Lactobacillus* spp.; Vaginal microbiota; in vivo trial; lactoferrin; vaginal infection

Influence of vaginal lactoferrin administration on amniotic fluid cytokines and its role against inflammatory complications of pregnancy.

[Maritati M¹](#), [Comar M²](#), [Zanotta N³](#), [Seraceni S²](#), [Trentini A⁴](#), [Corazza F⁵](#), [Vesce F⁶](#), [Contini C¹](#).

BACKGROUND:

An altered amniotic cytokine profile has been reported in inflammatory pregnancy complications with a leading role for IL-6, a marker of the foetal systemic inflammatory response. Up to this date there is no exhaustive information neither on the foetal cytokine balance nor on the best method for its modulation. We aimed to evaluate the influence of vaginal lactoferrin administration on amniotic fluid concentration of 47 cytokines, chemokines and growth factors.

METHODS:

Sixty women undergoing genetic amniocentesis were enrolled in an open-label clinical trial. 300 mg of vaginal lactoferrin (Florence, Italy) were randomly administered to obtain 3 groups: A, 20 untreated patients; B and C (20 patients in each) respectively treated 4 and 12 h before amniocentesis. Cytokines, chemokines and growth factors concentrations were quantified by a magnetic bead Luminex multiplex immunoassays panel technology. Data analysis was performed with the software Stata (v. 13.1) and GraphPad Prism (v. 5). Group comparisons were performed using Kruskal-Wallis followed by Mann-Whitney U tests, with Bonferroni correction for multiple comparisons. A $p < 0.05$ was considered significant.

RESULTS:

Among the 47 tested mediators, 24 (51.06%) were influenced by lactoferrin. 11 (23.4%), showed a highly significant difference ($p < 0.001$); among these IL-9, IL-15, IFN- γ , IP-10, TNF- α , IL-1 α and MCP-3 underwent a down-regulation, while IL-17 and FGF-basic, G-CSF, GM-CSF an up-regulation. Difference between group C and both B and A was small for IL-15, IP-10, IL-1 α , MCP-3, while it was negligible for IL-9, IFN- γ and TNF- α . IL-17 and the 3 growth factors were strongly enhanced in B and C groups. IL-17, FGF-basic and GM-CSF showed increasing concentrations in both B and C groups, while G-CSF resulted up-regulated only in group C. Significance was intermediate ($p < 0.01$) for the down regulated IL-2RA, IL-12p40 and IFN α 2 (6.38%) while it was small for 10 mediators (21.27%) 7 of which (IL-2, IL-4, eotaxin, PDGF-BB, RANTES, IL-18 and MIF) down-regulated and 3 (MCP-1, IL-3, and SDF-1 α) up-regulated.

CONCLUSION:

Lactoferrin down-regulates 17 pro-inflammatory amniotic mediators while up-regulating 7 anti-inflammatory amniotic mediators, 5 of which definitively belonging to an anti-inflammatory profile. These findings open to clinical investigation on its use against inflammatory complications of pregnancy.

KEYWORDS:

Abortion; Amniocentesis; Amniotic fluid; Cytokines; Inflammatory complications; Lactoferrin; Mediators; Pregnancy

[J Obstet Gynaecol Res.](#) 2014 Feb;40(2):583-5. doi: 10.1111/jog.12171. Epub 2013 Oct 7.

Administration of oral and vaginal prebiotic lactoferrin for a woman with a refractory vaginitis recurring preterm delivery: appearance of lactobacillus in vaginal flora followed by term delivery.

[Otsuki K¹](#), [Tokunaka M](#), [Oba T](#), [Nakamura M](#), [Shirato N](#), [Okai T](#).

Lactoferrin (LF) is one of the prebiotics present in the human body. A 38-year-old multiparous woman with poor obstetrical histories, three consecutive preterm premature rupture of membrane at the 19th, 23rd and 25th week of pregnancy, was referred to our hospital. She was diagnosed as having refractory vaginitis. Although estriol vaginal tablets were used for 4 months, the vaginitis was not cured. We administered vaginal tablets and oral agents of prebiotic LF, resulting in a Lactobacillus predominant vaginal flora. When she was pregnant, she continued to use the LF, and the Lactobacillus in the vaginal flora was continuously observed during pregnancy. An elective cesarean section was performed at the 38th week of pregnancy. When the administration of LF was discontinued after the delivery, Lactobacillus in the vaginal flora was disappeared.

KEYWORDS:

Lactobacillus; bacterial vaginosis; lactoferrin; preterm delivery

[J Obstet Gynaecol.](#) 2018 Mar 12:1-4. doi: 10.1080/01443615.2017.1399992. [Epub ahead of print]

Observational prospective study on Lactobacillus plantarum P 17630 in the prevention of vaginal infections, during and after systemic antibiotic therapy or in women with recurrent vaginal or genitourinary infections.

[Cianci A¹](#), [Cicinelli E²](#), [De Leo V³](#), [Fruzzetti F⁴](#), [Massaro MG³](#), [Bulfony A⁵](#), [Parazzini F⁵](#), [Perino A⁶](#).

Author information

Abstract

We performed a prospective cohort parallel observational study on the use of Lactobacillus plantarum P 17630 in the prevention of vaginal infections. Eligible were women with a diagnosis of bacterial vaginosis (<15 days) and documented history of recurrent vaginal infections; and/or cystitis (<15 days); and/or treatment with antibiotics for bacterial respiratory tract infections during

the week before the study entry. Study subjects were prescribed *Lactobacillus plantarum* P 17630 > 100.000.000 UFC one vaginal capsule per day for 6 days, then a capsule per week for 16 weeks. Eligible subjects were enrolled in two parallel cohorts: 85 women using (group A) and 39 not using (group B) *Lactobacillus plantarum* P 17630. The risk of recurrent infection within 4 months from the study entry, was higher among untreated women: multivariate OR 2.6 (95%CI 0.7-9.4). The modification of presence/intensity or symptoms was significant in both the study groups ($p < .001$). Impact statement What is already known on this subject? The *Lactobacillus plantarum* P 17630 has been shown to be active in the treatment of bacterial vaginosis and vaginal candidiasis. No data are available on its efficacy in the prevention of recurrent vaginal or urological infection or as a prevention strategy during systemic treatment with antibiotics. What do the results of this study add? This observational study suggests that *Lactobacillus plantarum* given for 4 months may lower the risk of recurrent infection in women with recurrent vaginal or genitourinary infection or after antibiotic systemic treatment for bacterial respiratory tract infection. The finding, however, is not statistically significant, possibly due to the lower than expected rate of infection observed in our population and consequently the limited power of the study. What are the implications of these findings for clinical practice and/or further research? New studies are needed in order to evaluate in different populations the role of *Lactobacillus plantarum* in lowering the risk of recurrent infection in a high-risk populations.

KEYWORDS:

Lactobacillus plantarum; Prevention; bacterial vaginosis

[Microbiology](#). 2018 Mar;164(3):349-358. doi: 10.1099/mic.0.000608. Epub 2018 Jan 23.

Anti-inflammatory effect of two *Lactobacillus* strains during infection with *Gardnerella vaginalis* and *Candida albicans* in a HeLa cell culture model.

[Santos CMA](#)¹, [Pires MCV](#)¹, [Leão TL](#)¹, [Silva AKS](#)¹, [Miranda LS](#)², [Martins FS](#)¹, [Silva AM](#)³, [Nicolli JR](#)¹.

[Author information](#)

[Abstract](#)

Lactobacilli are the dominant bacteria of the vaginal tract of healthy women and they play a major role in the maintenance of mucosal homeostasis, preventing genital infections, such as bacterial vaginosis (BV) and vulvovaginal candidiasis (VVC). It is now known that one mechanism of this protection is the influence that *lactobacilli* can exert on host immune responses. In this context, we evaluated two *Lactobacillus* strains (*L. plantarum* 59 and *L. fermentum* 137) for their immunomodulatory properties in response to *Gardnerella vaginalis* (BV) or *Candida albicans* (VVC) infections in a HeLa cell infection model. *G. vaginalis* and *C. albicans* triggered the secretion of pro-inflammatory cytokines (TNF- α , IL-1 β , IL-6 and IL-8) and the activation of NF- κ B

in HeLa cells, in contrast to *L. plantarum* 59 and *L. fermentum* 137. Treatments with the *Lactobacillus* strains or their cell-free supernatants before (pre-treatment) or after (post-treatment) the challenge with the pathogens resulted in decreased secretion of pro-inflammatory cytokines and decreased activation of NF- κ B. The treatments with *Lactobacillus* strains not only decreased the secretion of IL-8, but also its expression, as confirmed by gene reporter luciferase assay, suggesting transcription-level control by lactobacilli. In conclusion, *L. plantarum* 59 and *L. fermentum* 137 were confirmed to have an anti-inflammatory effect against *G. vaginalis* and *C. albicans* and they were able to influence signalling in NF- κ B pathway, making them interesting candidates as probiotics for the prevention or treatment of BV and VVC.

KEYWORDS:

Candida albicans; *Gardnerella vaginalis*; HeLa cells; *Lactobacillus* spp.; pro-inflammatory cytokines; vaginal probiotics

[Eur J Clin Microbiol Infect Dis](#). 2016 Oct;35(10):1701-8. doi: 10.1007/s10096-016-2715-8. Epub 2016 Jul 9.

Is it possible to prevent recurrent vulvovaginitis? The role of *Lactobacillus plantarum* I1001 (CECT7504).

[Palacios S](#)¹, [Espadaler J](#)², [Fernández-Moya JM](#)³, [Prieto C](#)⁴, [Salas N](#)¹.

[Author information](#)

Abstract

The purpose of this study was to prospectively evaluate the impact of the use of *L. plantarum* I1001 applied vaginally on Vulvovaginal Candidiasis (VVC) time-until-recurrence after treatment with single-dose vaginal clotrimazole. This was a clinical open-label, prospective study of two non-randomized parallel cohorts with symptomatic acute VVC: (1) 33 sexually active women 18-50 years old, prescribed a standard single-dose 500 mg vaginal tablet of clotrimazole followed by vaginal tablets with *L. plantarum* I1001 as adjuvant therapy, and (2) 22 women of similar characteristics but prescribed single-dose clotrimazole only. Use of the probiotic and factors that might influence recurrence risk (age, recurrent VVC within previous year, antibiotic prior to study enrolment, diaphragm or IUD contraception, among others) were included in a multivariate Cox regression model to adjust for potential between-cohort differences. Probiotic use was associated with a three-fold reduction in the adjusted risk of recurrence (HR [95 %CI]: 0.30 [0.10-0.91]; $P = 0.033$). Adjusted free-survival recurrence was 72.83 % and 34.88 % for the probiotic and control groups, respectively. A higher cumulative recurrence was also observed in cases with use of antibiotics prior to enrolment (HR [95 %CI]: 10.46 [2.18-50.12]; $P = 0.003$). Similar findings were found at six months after azole treatment in women with RVVC. Overall, good compliance with the probiotic was reported for 91.3 % of women. The study suggests that follow-up therapy with vaginal tablets with *L. plantarum* I1001 could increase the effectiveness of single-dose 500 mg clotrimazole at preventing recurrence of VVC, an effect that was also

observed in women with recurrent vulvovaginal candidiasis (RVVC) after six months of azole treatment.

[Eur J Obstet Gynecol Reprod Biol.](#) 2014 Nov;182:136-9. doi: 10.1016/j.ejogrb.2014.09.018. Epub 2014 Sep 17.

Lactobacillus plantarum P17630 for preventing Candida vaginitis recurrence: a retrospective comparative study.

[De Seta F¹](#), [Parazzini F²](#), [De Leo R³](#), [Banco R³](#), [Maso GP³](#), [De Santo D³](#), [Sartore A³](#), [Stabile G³](#), [Inglese S³](#), [Tonon M³](#), [Restaino S³](#).

Author information

Abstract

BACKGROUND:

Recurrence is a frequent complaint of patients with vulvovaginal candidiasis (VVC). Although the pathogenesis of VVC remains a controversial issue, disruption of the balance between the vaginal microbiota may facilitate overgrowth by *Candida*. Some probiotic bacterial strains can suppress *Candida albicans*; *Lactobacillus plantarum* P17630 is able to attach to vaginal epithelial cells and significantly reduce the adhesion of *C. albicans*.

OBJECTIVE:

To evaluate the effect of the application of *Lactobacillus plantarum* P17630 in restoring the vaginal microbiota and prevention of relapses among women with acute VVC undergoing conventional (azole) local and main therapy.

METHODS:

Retrospective comparative study. We recruited 89 women with a diagnosis of VVC, who were placed into two groups on the basis of reported treatment. The control group was treated with a daily dose of 2% clotrimazole vaginal cream at bedtime for 3 days, followed by vaginal application of a capsule containing lubricant once a day for 6 days and then once a week for another 4 weeks. The probiotic group was treated with the same azole-based protocol but followed by vaginal application of a capsule containing *Lactobacillus plantarum* P17630 ($>10^8$ CFU) once a day for 6 days and then once a week for another 4 weeks beginning the day following clotrimazole discontinuation. Clinical and diagnostic patterns were monitored for three months of follow-up.

RESULTS:

At the end of study the probiotic-treated women showed a statistically significant increase in *Lactobacillus* values "+++" (80% versus 40%, $p<0.001$) and a better subjective resolution of symptoms such as vaginal discomfort described as burning or itching (90% versus 67.5%, $p<0.03$). Among controls there was a non-significant increase at 3 months of recurrence of infection, but a significant increase of women with value of pH=5 or >5 .

CONCLUSION:

Although the results of different studies are controversial, most have suggested use of probiotics in the prevention or treatment of VVC, and no adverse effects have been reported. Our data with *L. plantarum* P17630 (Gyno-Canesflor - Bayer) confirm the role of this specific strain as a potential empirical preventive agent for reducing vaginal discomfort after conventional treatment of acute VVC and shifting the vaginal milieu toward a predominance of lactobacilli with an improvement of the vaginal pH value.

[J Appl Microbiol.](#) 2015 Apr;118(4):1034-47. doi: 10.1111/jam.12739. Epub 2015 Jan 29.

Preventive effect of *Lactobacillus reuteri* CRL1324 on Group B *Streptococcus* vaginal colonization in an experimental mouse model.

[De Gregorio PR¹](#), [Juárez Tomás MS](#), [Leccese Terraf MC](#), [Nader-Macías ME](#).

[Author information](#)

Abstract

AIMS:

To assess the preventive effect of different intravaginal (i.va.) doses of *Lactobacillus reuteri* CRL1324 against vaginal colonization by Group B *Streptococcus* (GBS) in a murine experimental model.

METHODS AND RESULTS:

The major virulence factors of four vaginal GBS clinical isolates were determined to select the most virulent strain and set up a murine model of streptococcal vaginal colonization. Later, the effect of four and seven doses of 10(8) viable cells of *Lact. reuteri* CRL1324 i.va. administered, prior to the GBS challenge was studied. Seven doses of lactobacilli were able to significantly reduce the number of viable GBS cells, while four doses showed no preventive effect. Both doses reduced the leucocyte influx induced by GBS. Seven doses caused a slight increase in the *Lact. reuteri* CRL1324 vaginal colonization compared with four doses and reduced murine vaginal pH compared to control mice.

CONCLUSIONS:

Lactobacillus reuteri CRL1324 evidenced a preventive effect on GBS vaginal colonization in an experimental mouse model.

SIGNIFICANCE AND IMPACTS OF THE STUDY:

Maternal GBS colonization is one of the most important risk factors for developing disease in newborns. *Lactobacillus reuteri* CRL1324 could be considered as a new biological agent to reduce infections caused by this micro-organism.

KEYWORDS:

Group B Streptococcus; lactobacilli; mouse experimental model; preventive effect; urogenital tract; vaginal probiotic

[J Med Microbiol.](#) 2014 Jul;63(Pt 7):931-5. doi: 10.1099/jmm.0.073080-0. Epub 2014 May 16.

Characterization of culturable vaginal *Lactobacillus* species among women with and without bacterial vaginosis from the United States and India: a cross-sectional study.

[Madhivanan P](#)¹, [Raphael E](#)², [Rumphs A](#)³, [Krupp K](#)⁴, [Ravi K](#)⁵, [Srinivas V](#)⁵, [Arun A](#)⁵, [Reingold AL](#)⁶, [Klausner JD](#)⁷, [Riley LW](#)⁶.

Author information

Abstract

Lactobacillus species play an integral part in the health of the vaginal microbiota. We compared vaginal *Lactobacillus* species in women from India and the USA with and without bacterial vaginosis (BV). Between July 2009 and November 2010, a cross-sectional study was conducted among 40 women attending a women's health clinic in Mysore, India, and a sexually transmitted diseases clinic in San Francisco, USA. Women were diagnosed with BV using Amsel's criteria and the Nugent score. *Lactobacillus* 16S rDNA was sequenced to speciate the cultured isolates. Ten Indian and 10 US women without BV were compared with an equal number of women with BV. *Lactobacilli* were isolated from all healthy women, but from only 10% of Indian and 50% of US women with BV. 16S rDNA from 164 *Lactobacillus* colonies was sequenced from healthy women (126 colonies) and women with BV (38 colonies). Seven cultivable *Lactobacillus* species were isolated from 11 Indian women and nine species from 15 US women. The majority of *Lactobacillus* species among Indian women were *L. crispatus* (25.0%), *L. jensenii* (25.0%) and *L. reuteri* (16.7%). Among US women, *L. crispatus* (32.0%), *L. jensenii* (20.0%) and *L. coleohominis* (12.0%) predominated. *L. jensenii* and *L. crispatus* dominated the vaginal flora of healthy Indian and US women. Indian women appeared to have a higher percentage of obligate heterofermentative species, suggesting the need for a larger degree of metabolic flexibility and a more challenging vaginal environment.

[Taiwan J Obstet Gynecol.](#) 2016 Aug;55(4):515-8. doi: 10.1016/j.tjog.2016.06.003.

Oral *Lactobacillus rhamnosus* GR-1 and *Lactobacillus reuteri* RC-14 to reduce Group B Streptococcus colonization in pregnant women: A randomized controlled trial.

[Ho M](#)¹, [Chang YY](#)¹, [Chang WC](#)¹, [Lin HC](#)², [Wang MH](#)¹, [Lin WC](#)¹, [Chiu TH](#)³.

Author information
Abstract

OBJECTIVE:

This study is to examine the effect of *Lactobacillus rhamnosus* GR-1 and *Lactobacillus reuteri* RC-14 taken orally before bedtime on Group B *Streptococcus* (GBS)-positive pregnant women with respect to becoming GBS negative.

MATERIALS AND METHODS:

In total, 110 pregnant women at 35-37 weeks of gestation who were diagnosed by GBS culture as being GBS positive for both vaginal and rectal GBS colonization were randomly assigned to be orally treated with two placebo capsules or two probiotic capsules (containing *L. rhamnosus* GR-1 and *L. reuteri* RC-14) before bedtime until delivery. All women were tested for vaginal and rectal GBS colonization again by GBS culture on admission for delivery.

RESULTS:

Of the 110 participants, 99 completed the study (49 in the probiotic group and 50 in the placebo group). The GBS colonization results changed from positive to negative in 21 women in the probiotic group (42.9%) and in nine women in the placebo group (18.0%) during this period (Chi-square $p=0.007$).

CONCLUSION:

Oral probiotic containing *L. rhamnosus* GR-1 and *L. reuteri* RC-14 could reduce the vaginal and rectal GBS colonization rate in pregnant women.