Inhibitory Effects of *Lactobacillus* Culture Supernatants on *Candida albicans*

Yuko Matsuda^{1,2} Otomi Cho¹ Daiki Ogishima² Takashi Sugita¹

¹Department of Microbiology, Meiji Pharmaceutical University, Tokyo, Japan

²Department of Obstetrics and Gynecology, Juntendo University Nerima Hospital, Tokyo, Japan

Introduction

Lactobacillus species predominate in the vaginal microbiota, where they maintain an adequate pH and help prevent infection by pathogens.

Vulvovaginal candidiasis (VVC) is a common infection of the vaginal mucosa caused by *Candida* species, mostly (90%) *C. albicans*. In this study, we examined the mechanisms underlying the inhibitory effects of *Lactobacillus* culture supernatants, especially those from *L. gasseri* and *L. crispatus*, on the budded-to-hyphal transition (BHT) of *C. albicans*, biofilm formation by the fungus, and fungal adhesion to HeLa cells.

Vaginal microbiota of Japanese women

Comprehensive analysis using next-generation sequencing

Vaginal microbiota of Japanese pregnant women

C. albicans in the vagina

C. albicans assumes a yeast and/or hyphal form, in addition to forming biofilms in the vagina. The 2010 report of Harriott *et al.*¹⁾ was the first to describe mucosal *Candida* biofilm formation in murine models of vaginitis. The *in vivo* vaginal biofilm development phases closely resemble those of *in vitro* biofilms.

1) Harriott *et al.*
Microbiology
2010;156:3635–3644

Materials and Methods

Microorganisms

C. albicans SC5314
L. gasseri JCM 1131
L. crispatus JCM 1185

Hyphal formation assay

Culture supernatant

Adhesion assay

Biofilm formation assay (XTT reduction assay)

Results

Inhibition of hyphal formation

Microscopic findings

Inhibition of biofilm formation

Initial colonization phase

Maturation phase

Gene expression levels in biofilms

Inhibition of adhesion to HeLa cells

Microscopic findings

Colony forming unit

Regulation of *C. albicans* BHT

Conclusion

- Metabolites of *L. gasseri* and *L. crispatus* inhibited hyphal formation, biofilm formation, and adhesion to HeLa cells by *C. albicans*. *L. gasseri* and *L. crispatus* predominated in the vaginal bacterial microbiota of healthy women, which was clinically consistent with the inhibitory effects of these predominant species on *C. albicans*.
- This is the first study to report that *Lactobacillus* species in the vaginal microbiome inhibit *C. albicans* biofilm formation, by suppressing the expression of genes in the BHT pathway.
- Our results will facilitate the development of better management strategies for VVC.