Ingestion of Yogurt Containing *Lactobacillus acidophilus* Compared With Pasteurized Yogurt as Prophylaxis for Recurrent Candidal Vaginitis and Bacterial Vaginosis

Eliezer Shalev, MD; Shlomo Battino, MD; Ehud Weiner, MD; Raul Colodner, MsC; Yoram Keness, PhD

To compare and assess ingestion of yogurt that contained live *Lactobacillus acidophilus* with pasteurized yogurt as prophylaxis for recurrent bacterial vaginosis (BV) and candidal vaginitis, we designed a crossover trial during which patients were examined monthly for candidal infection and BV while they were receiving either a pasteurized yogurt or a yogurt that contained live *L acidophilus*. Forty-six patients in 2 groups of 23 were randomly assigned to each of the study groups. At least 28 (61%) participated during the first 4 months of the study. Seven patients completed the entire study protocol. We concluded that daily ingestion of 150 mL of yogurt, enriched with live *L acidophilus*, was associated with an increased prevalence of colonization of the rectum and vagina by the bacteria, and this ingestion of yogurt may have reduced episodes of BV. *Arch Fam Med. 1996;5:593-596*

Candida albicans, which can cause vaginitis, is one of the most common pathogens that repeatedly infects many women. The infection is superficial and is characterized by the overgrowth of the fungus on epithelial cells.

Little is known about the pathogenesis of recurrent vulvovaginal candidiasis. The following factors can predispose women to recurrent infections: pregnancy; use of oral contraceptives; diabetes mellitus; use of tight, restrictive clothing; and use of antibiotics.[1] Most women with recurrent candidal vaginitis have no identifiable risk factor.[2] The concept that lactobacilli might be useful in displacing and replacing harmful microorganisms on mucosal surfaces dates back to Elie Metchnikoff in 1908.[3]

Therapy with *Lactobacillus* species, administered either orally or vaginally, is popular in the practices of diverse "alternative healers,"[4] as well as those of some physicians.[5,6] Because of the reported use of yogurt douches for the treatment of vaginitis, the adherence of *Lactobacillus* species to normal human vaginal epithelial cells was tested with the use of in vitro methods by Wood and colleagues.[7] *Lactobacillus acidophilus*, isolated from yogurt, showed a significantly lower adherence than did other *Lactobacillus* species; thus, commercial yogurt may not be a reliable way to deliver lactobacilli. However, Hilton and colleagues[6] concluded in their study that daily ingestion of yogurt that contained *Lactobacillus acidophilus* decreased both candidal colonization and infection. Their study lacked a control with pasteurized yogurt.

As patients use *Lactobacillus*-containing preparations, often in preference to topical antifungal agents, the true value of this approach deserves analysis.[8]

Bacterial vaginosis (BV) is the primary cause of abnormal vaginal discharge in women of reproductive age. At least 30% to 50% of all women in epidemiologic studies of women with vaginitis have BV.[9,10] *Lactobacillus* establishes a low vaginal pH by producing lactic acid. Some types of *Lactobacillus* also have generated hydrogen peroxide. The low pH value and the presence of hydrogen peroxide inhibit the growth of most other microorganisms.[11] Neri and colleagues[12] studied 32 pregnant women with BV who were treated with an intravaginal application of

From the Departments of Obstetrics and Gynaecology (Drs Shalev, Battino, and Weiner) and Microbiology (Mr Colodner and Dr Keness), Central Emek Hospital, Afula, Israel.

yogurt. The results were favorable, indicating that the continuous correction of vaginal pH and *Lactobacillus* flora is crucial for normal vaginal ecology.

The purpose of this study was to determine if daily ingestion of yogurt that was made with live *L acidophilus* compared favorably with pasteurized yogurt in reducing the frequency of candidal vaginitis and BV.

PATIENTS AND METHODS

Women with at least 4 documented episodes of vaginal candidiasis or BV during the last year were recruited from the community gynecology clinic of the Central Emek Hospital, Afula, Israel. Patients who were excluded from the study included women with vaginal pathogens other than BV or *Candida*, women who were receiving long-term antibiotic or immunosuppressive therapy, and women who had ingested yogurt daily before the study.

At enrollment to the study, each patient signed an informed consent form for participation in the research project. At the initial evaluation, a questionnaire was given to each patient. The questionnaire covered patient gynecologic, dietary, personal, sexual, menstrual, and chronic medical problems, as well as family history.

forty-six women entered into the study. Twenty women had BV, 18 had candidal vaginitis, and 8 had both

Each patient underwent a physical examination of the fornix vaginae; specimens of the vaginal wall and endocervix were inoculated onto Sabouraud glucose agar plates (selective for *Candida*), Thayer-Martin media (selective for *Neisseria gonorrhoeae*), and Rogosa agar for *Lactobacillus*. Slides were prepared for Gram staining and normal saline solution preparations. The vaginal pH was determined. When clinically indicated, viral cultures and specimens for the detection of *Chlamydia* were obtained. Rectal cultures for *Candida* and lactobacilli were obtained. All specimens were immediately transferred to the laboratory for processing. Cultures were checked after 24 and 48 hours of incubation.

Lactobacillus acidophilus was identified with API-50-CHL (Biomerieux, Lyon, France), a ready-to-use medium that enables the fermentation of 49 carbohydrates on the API-50-CH strip to be studied. The results make up the biochemical profile of the strain and are used in its identification. *Candida albicans* was identified with API-20-C-AUX (Biomerieux, Lyon, France). All Gram-stained vaginal smears were evaluated for the presence of inflammatory cells, clue cells for BV, and other bacteria.

The patients were randomly assigned to 1 of 2 groups. In 1 group, patients were instructed to eat 150 mL of yogurt that was enriched with *L acidophilus* daily for 2 months; then, for 2 months, patients were not supposed to eat yogurt at all, and then, for the next 2 months, they switched to eating 150 mL of pasteurized yogurt daily. In the other group, patients began by eating the pasteurized yogurt diet; then, after 2 months without yogurt, they switched to eating the *Lactobacillus*-enriched yogurt.

A yogurt was chosen for the study that yielded more than 10^8 colony-forming units per milliliter of *L acidophilus*, which is a hydrogen peroxide–producing strain.

Patients were seen at monthly intervals for at least 6 months. Data that related to compliance symptoms of vaginitis, sexual activity, menstrual period, and changes in medication and diet were recorded. Patients were examined, and microbiologic sampling was repeated at each visit. Topical antifungal agents were given as treatment of clinical vaginitis. No colonization without vaginitis was treated. No systemic antifungal agents were used during the study. No antibiotic therapy for BV was used.

A supply of yogurt was given to the patients at each visit. The type of yogurt was blinded to the medical provider and the laboratory staff; compliance was recorded monthly. A woman who failed to eat yogurt for 3 days weekly in either group was excluded from all analyses.

Clinical vaginitis was defined by the presence of erythema and an exudative discharge that was associated with symptoms of pruritus or pain.

Candidal vaginitis was defined by the presence of clinical vaginitis and a positive culture for *Candida* species.

Bacterial vaginosis was defined by a pH greater than 4.5, a positive amine test, and the presence of clue cells in the microscopic analysis of the vaginal secretions.

Data were analyzed by the Medical Statistics Department of Kupat Holim, Tel Aviv, Israel. A 2-tailed *t* test and Fisher exact test with significance set at $P<.05$ was used in this analysis.

RESULTS

Seventy-five women who reported a history of recurrent candidal vaginitis, BV, or both were recruited for the study. Eighteen had no evidence of vaginitis, and 8 women had infections due to other causes (5 patients, *Trichomonas* species; 2 patients, herpes simplex virus; and 1 patient, *Chlamydia*). Three women were excluded because they failed to eat the yogurt. All participants demonstrated good compliance with the ingestion of the yogurt.

Forty-six women entered into the study. Twenty women had BV, 18 had candidal vaginitis, and 8 had both vaginal conditions at the start of the study. Twenty-three randomly assigned patients began eating the yogurt that contained *Lactobacillus* (group 1), and the other 23 patients began eating the pasteurized yogurt (group 2). Comparison of the 2 groups did not show significant differences in age (mean±SD, 29±6 years); the mean±SD age in group 1 was compared with that (31±8 years) in group 2.

There was no significant difference in their marital status; 68% and 80% were married in groups 1 and 2, respectively, and there was no significant difference in their birth control, with 71% and 65% using birth control pills in groups 1 and 2, respectively. Because of the high attrition rate, the figures demonstrate data from the first 4-month period. In **Figure 1** through **Figure 3**, the number at the top of each column represents the number of women who were checked.

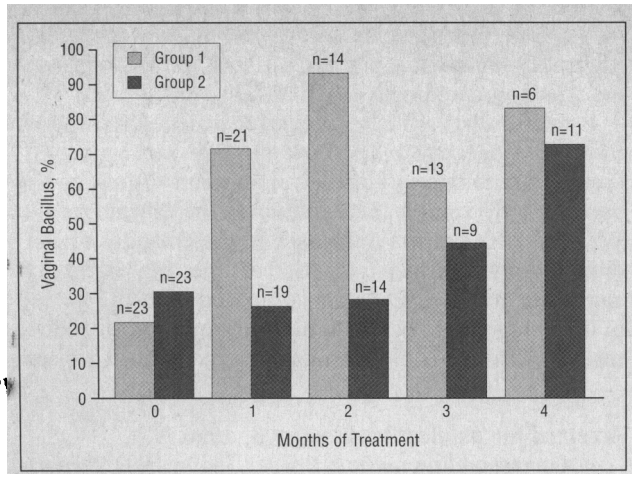

Figure 1. *Percentage of women with positive* Lactobacillus acidophilus *culture during each study month. Group 1 consisted of women who ingested yogurt that contained live* L acidophilus*; group 2, women who ingested pasteurized yogurt. The number at the top of each column represents the number of women checked.*

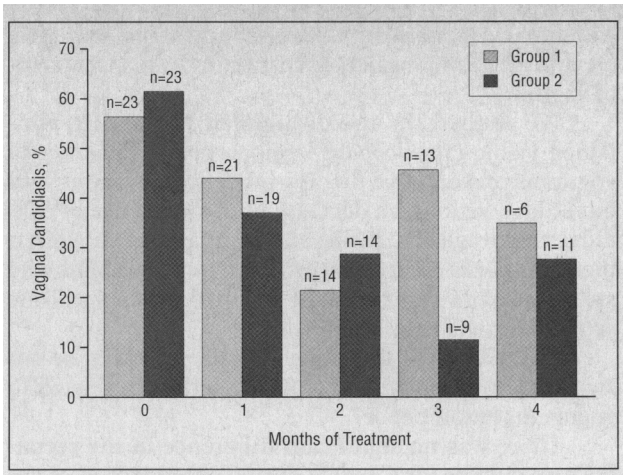

Figure 2. *Percentage of women with positive* Candida *culture during each study month. Group 1 consisted of women who ingested yogurt that contained live* Lactobacillus acidophilus*; group 2, women who ingested pasteurized yogurt. The number at the top of each column represents the number of women checked.*

There was a significant difference in the isolation of *Lactobacillus* between the 2 groups. Before they entered the study, 11 (24%) of the women had positive vaginal cultures for *L acidophilus*; after 1 or 2 months of eating yogurt that contained *Lactobacillus*, there was a significant difference ($P<.05$) between the 2 groups (Figure 1). The same pattern was demonstrated in stool cultures for *L acidophilus*. When *L acidophilus* was present in the rectal culture, the probability of its presence in the vagina was 68%.

There was a steady reduction in vaginal cultures that were positive for *Candida* in both groups—from 60% in the first month to 20% to 28% after 2 months of treatment (Figure 2). No significant difference between the 2 groups was demonstrated after 1 or 2 months of participation.

A significant reduction in the episodes of BV was noted in group 1—from 60% of the episodes of BV at the start to 25% after 1 month in group 1 compared with 50% of the episodes of BV in group 2 (Figure 3) ($P=.004$). The significant difference continued after 2 months.

The attrition rate in our study was high because participation involved inconvenience to the patient, with only 7 women completing the original study protocol.

There was a significant reduction in the number of episodes of BV during the time when yogurt that contained *L acidophilus* was eaten compared with that during the period when pasteurized yogurt was eaten. Six of these 7 patients who completed the study had 1 to 2 episodes of BV during the time when pasteurized yogurt was eaten compared with 1 episode of BV during the period when yogurt that contained *L acidophilus* was eaten ($P<.001$).

In the 7 women who completed the original study protocol, there was a significant difference in the number of isolated positive vaginal cultures with *L acidophilus*, with 12 (86%) of 14 visits during the period of eating yogurt that contained *L acidophilus* compared with 5 (36%) of 14 visits during the period of eating pasteurized yogurt ($P=.001$).

There was no significant difference in candidal vaginitis or candidal colonization between the 2 study periods in the 7 women who completed the study. Episodes of candidal vaginitis were noted in 3 (21%) of 14 visits during the period of eating yogurt that contained *L acidophilus* compared with 5 (36%) of 14 visits during the period of eating pasteurized yogurt ($P=.67$).

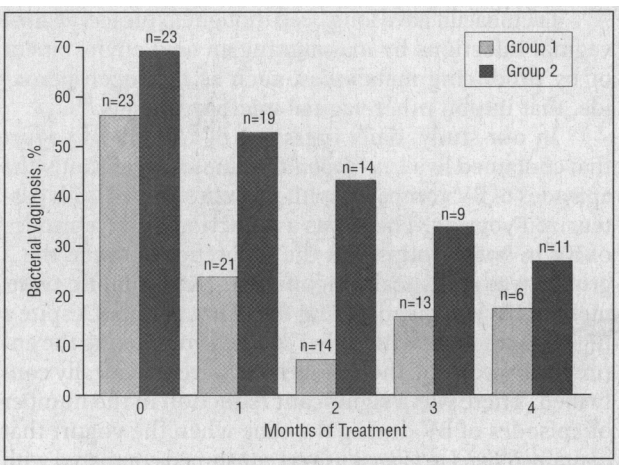

Figure 3. *Percentage of women with bacterial vaginosis during each study month. Group 1 consisted of women who ingested yogurt that contained live* Lactobacillus acidophilus*; group 2, women who ingested pasteurized yogurt. The number at the top of each column represents the number of women checked.*

Patients were treated only when severe manifestations of vaginitis were found; overall, not more than 20% of the patients were treated with topical antifungal preparations without any difference between the 2 groups.

The vaginal isolates of *Candida* revealed that 88% were *C albicans*, 8% were *Candida glabrata*, 3% were *Candida tropicalis*, and 1% were *Candida pharingosa*.

COMMENT

Candidal vaginitis is the source of great discomfort and inconvenience; this inflammation stimulates the self-administration of diverse therapeutic agents as none of the myriad topical and systemic therapies appear to be

"the answer." Many studies have been performed to evaluate different *Lactobacillus* preparations in the treatment of vaginitis.[3-6]

We studied the use of ingested yogurt that contained viable *L acidophilus* compared with pasteurized yogurt as preventative therapy for candidal vaginitis. In our study, we found a decrease in the incidence of candidal vulvovaginitis during the study period; however, there was no difference between the group of patients who ate pasteurized yogurt and the group of patients who ate yogurt with viable *L acidophilus*.

The reason for this phenomenon could not be answered by this study: is it a placebo effect or related to yogurt ingestion per se?

There was no significant difference in the rectal-positive culture for *Candida* during either period of yogurt ingestion. We found a strong correlation between a rectal-positive candidal culture and vaginal candidal colonization—a fact that may support the theory of symptomatic recurrence being associated with rectal recolonization.

Lactobacilli have long been thought to protect against vaginal infections by maintaining an acid environment or by producing metabolics, such as hydrogen peroxide, that inhibit other vaginal microorganisms.[10]

In our study, daily ingestion of 150 mL of yogurt that contained live *L acidophilus* reduced significantly the episodes of BV compared with those associated with pasteurized yogurts. There was a reduction in the episodes of BV in both groups, but the difference between the 2 groups was statistically significant. No antibiotic treatment of BV was given during the study period. Despite a high dropout rate with only 7 women completing the entire study protocol, the main results were statistically confirmed. There was a significant reduction in the number of episodes of BV during the time when the yogurt that contained live *Lactobacillus* was consumed compared with that when the pasteurized yogurt was consumed. A significant increase in positive vaginal culture isolation of *L acidophilus* was also shown.

In a letter to *Lancet* in 1987, Fredricsson et al[13] presented clinical evidence that suggested that an intravaginal application of yogurt for the treatment of BV is rarely effective. However, Neri et al[12] showed favorable results in treating a total of 32 women with BV in the first trimester of pregnancy with intravaginal applications of yogurt.

To our knowledge, this is the first report to demonstrate prophylaxis for BV by ingestion of yogurt containing live *L acidophilus*.

Despite conflicting data about the ability of diet and *L acidophilus* supplementation to alter the gastrointestinal microbiota, we anticipate an increase in *L acidophilus* colony counts in rectal and vaginal specimens after ingestion of yogurt that contain live *L acidophilus*.[7,14-16]

Yogurt that contained *L acidophilus* was chosen for the study because evidence suggested that *L acidophilus* had improved survival on passage through the gastrointestinal tract compared with other *Lactobacillus* species.[14]

In summary, during the period of ingesting yogurt that contained live *L acidophilus*, there was a clear increase in colonization of the rectum and vagina by the bacteria and a significant reduction in the episodes of BV. We could not show a difference in the episodes of candidal vaginitis between the period of ingesting yogurt that contained live *L acidophilus* compared with the period of ingesting pasteurized yogurt, although a clear reduction in the number of episodes occurred in both groups.

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Corresponding author: Eliezer Shalev, MD, Department of Obstetrics and Gynaecology, Central Emek Hospital, Afula 18101, Israel.

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