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ASSESSMENT OF THE EFFECTIVENESS OF CORRECTING INTESTINAL MICROBIocenosis IN THE COMPREHENSIVE MANAGEMENT OF RECURRENT BACTERIAL VULVOVAGINITIS IN ADOLESCENT GIRLS

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ABSTRACT

To evaluate the clinical, microbiological, and preventive efficacy of correcting intestinal microbiocenosis in addition to standard antibacterial therapy in the comprehensive treatment of recurrent bacterial vulvovaginitis in adolescent girls. The statistical model was developed based on data from 120 adolescent girls aged 12–17 years. Participants were divided into a main group and a control group of 60 patients each. In the main group, a probiotic approach aimed at correcting intestinal microbiocenosis was administered alongside standard etiotropic treatment, whereas the control group received the standard treatment regimen. Clinical symptoms, vaginal pH, as well as microscopic and microbiological parameters were assessed before and after treatment, as well as during the 3- and 6-month follow-up periods.

According to the model, complete resolution of clinical symptoms was observed in 53 (88.3%) cases in the main group and 44 (73.3%) cases in the control group (RR=1.20; 95% CI: 1.01–1.44; p=0.037). Normalization of vaginal pH occurred in 85.0% and 70.0% of cases, respectively (RR=1.21; 95% CI: 1.00–1.48; p=0.049). Microbiological cure was achieved in 81.7% and 63.3% of cases

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(RR=1.29; 95% CI: 1.03–1.62; $p=0.025$). At the 6-month follow-up, recurrence was 16.7% and 35.0% (RR=0.48; 95% CI: 0.25–0.92; OR=0.37; 95% CI: 0.16–0.88; $p=0.022$).

The modeled results suggest that incorporating intestinal microbiocenosis correction into comprehensive treatment may improve clinical recovery rates and reduce the risk of long-term recurrence. A real clinical trial requires ethical approval and actual patient data.

Keywords: Adolescent girls, vulvovaginitis, bacterial vulvovaginitis, recurrence, intestinal microbiocenosis, probiotics, *Lactobacillus*, microbiota, comprehensive treatment, prevention.

INTRODUCTION

Adolescence is characterized by rapid morphofunctional development of the reproductive system, hormonal changes, and adaptation of the immune system. During this period, inflammatory diseases of the external and internal genitalia, particularly vulvovaginitis, represent one of the urgent challenges in pediatric and adolescent gynecology [1–3].

Impairment of local defense mechanisms, hygiene-related factors, antibiotic use, alterations in immunological reactivity, endocrine factors, and disruption of the microbiocenosis play a significant role in the development of vulvovaginitis [4, 5]. In recurrent forms, the overall microbiological balance of the body may also play an important role alongside the local microflora [6, 7].

The state of the vaginal microbiota, particularly the presence of an adequate level of *Lactobacillus* species, is a crucial factor in maintaining the stability of the vaginal environment [8–11]. In bacterial dysbiosis, a depletion of beneficial microorganisms and an overgrowth of opportunistic pathogens can create conditions that sustain the inflammatory process [12, 13].

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In recent years, interest in studying the relationship between the microbiota and reproductive health has grown. A 2022 meta-analysis encompassing 10 studies and 1,234 participants demonstrated that probiotics reduced the risk of bacterial vaginosis recurrence [14]. A 2024 meta-analysis of 35 RCTs also noted the potential efficacy of probiotics as an adjunctive approach [15].

At the same time, most of the available evidence pertains to the adult female population. Due to the microbiological and physiological characteristics of puberty in adolescent girls, a separate evaluation of outcomes is necessary. There are insufficient controlled studies evaluating the impact of correcting the intestinal microbiota on the course of recurrent bacterial vulvovaginitis in adolescents compared with a control group. Consequently, it was hypothesized that adding intestinal microbiota correction to standard therapy would improve clinical and microbiological cure rates and reduce recurrence rates.

The aim of the study was to evaluate the clinical, microbiological, and long-term preventive efficacy of intestinal microbiota correction in the comprehensive treatment of recurrent bacterial vulvovaginitis in adolescent girls.

MATERIALS AND METHODS

Study setting. The statistical model of the study was adapted to the setting of the Maternity Department of the Fergana City Medical Association. The model included 120 adolescent girls aged 12–17 years with clinical and laboratory signs of recurrent bacterial vulvovaginitis.

Important methodological note: the 120 patients, group allocations, and results presented in this article were generated as a statistical model. They should not be interpreted as actual medical record data. In the final publication version, these figures will be replaced with data from an actual clinical cohort.

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Study design. Main group (n=60) – standard etiotropic treatment combined with a comprehensive approach aimed at correcting intestinal microbiocenosis. Control group (n=60) – standard treatment. Study type: a prospective comparative study with a control group. Follow-up period: 6 months.

Inclusion criteria: Age 12–17 years; puberty; recurrent vulvovaginitis; at least 3 episodes in the last 12 months; pruritus, burning, abnormal discharge, or vulvar hyperemia; laboratory signs confirming bacterial etiology.

Exclusion criteria: Predominantly fungal vulvovaginitis, trichomoniasis and other sexually transmitted infections, parasitic diseases, severe immunodeficiency, severe endocrine disorders, and failure to complete follow-up.

Clinical evaluation. Pruritus, discharge, hyperemia, burning, and dysuria were assessed on a 0–3 point scale. Vaginal pH, microscopic examination, microbiological culture, and microflora status were taken into account. In cases with a bacterial vaginosis component, the use of the Nugent criteria [16] was provided for.

Assessment of intestinal microbiocenosis. Bacteriological stool examination was performed before and after treatment. The counts of Bifidobacterium, Lactobacillus, and opportunistic pathogens were expressed as log₁₀ CFU/g; signs of dysbiosis were evaluated based on current laboratory criteria.

Standard treatment. Both groups received etiotropic antibacterial therapy and local decontamination in accordance with the current clinical protocol.

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Correction of intestinal microbiocenosis. In the study group model, a probiotic regimen based on Lactobacillus and Bifidobacterium strains was added to the standard treatment. The specific drug name, dosage, and duration are determined in accordance with actual clinical protocols.

Outcome measures. The primary outcome measure was disease recurrence (reappearance of clinical signs with laboratory confirmation) during the 6-month follow-up period. Secondary outcome measures included: clinical cure (all symptoms reduced to a score of 0 at the end of treatment), normalization of vaginal pH ($\text{pH} \leq 4.5$), microbiological cure (Nugent score of 0–3 and absence of opportunistic pathogen predominance), vaginal smear leukocyte count, the relative abundance of Lactobacillus, and intestinal microbiocenosis parameters. Evaluations were conducted before treatment, at the end of treatment, and at 3 and 6 months post-treatment.

Statistical analysis. Quantitative variables were expressed as $M \pm SD$, and categorical variables as n (%). Between-group comparisons of quantitative variables were performed using Student's t-test, while categorical variables were compared using the χ^2 test or Fisher's exact test; RR, OR, and 95% CI were calculated.

Ethical considerations. The clinical parameters in this article represent a statistical model. In an actual study, the requirements for ethical review board approval, informed consent from a parent or legal guardian, and the protection of minors' rights are fully observed.

RESULTS

According to the model, the main and control groups were considered comparable in terms of baseline parameters. The mean age was 15.0 ± 1.4 years in the main group and 15.1 ± 1.3 years in the control group. The number of episodes per year

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was 3.7 ± 0.8 and 3.6 ± 0.7 , respectively. No statistically significant differences were observed between the groups in baseline clinical and laboratory parameters (all $p > 0.05$; Table 1).

Table 1. Baseline clinical characteristics of the study groups.

Parameter	Study group (n=60)	Control group (n=60)	p
Age, years	$15,0 \pm 1,4$	$15,1 \pm 1,3$	0,70
Number of episodes per year	$3,7 \pm 0,8$	$3,6 \pm 0,7$	0,50
Pruritus	51 (85,0%)	50 (83,3%)	0,79
Pathological discharge	54 (90,0%)	53 (88,3%)	0,76
Vulvar hyperemia	48 (80,0%)	47 (78,3%)	0,81
Dysuria	19 (31,7%)	20 (33,3%)	0,84
Vaginal pH	$5,6 \pm 0,5$	$5,5 \pm 0,4$	0,24
Nugent score	$7,2 \pm 1,1$	$7,1 \pm 1,2$	0,63

Complete resolution of clinical symptoms after treatment was recorded in 53 (88.3%) cases in the main group and 44 (73.3%) in the control group (Table 2). The likelihood of clinical cure was 1.20 times higher in the main group (RR=1.20; 95% CI: 1.01–1.44; $p=0.037$).

Normalization of vaginal pH was observed in 51 (85.0%) patients in the main group and 42 (70.0%) in the control group (RR=1.21; 95% CI: 1.00–1.48; $p=0.049$).

Microbiological cure was noted in 49 (81.7%) patients in the main group and 38 (63.3%) in the control group (RR=1.29; 95% CI: 1.03–1.62; OR=2.58; 95% CI: 1.11–5.97; $p=0.025$).

After treatment, the vaginal smear leukocyte count (per high-power field) was 6.1 ± 2.2 in the main group and 8.4 ± 2.7 in the control group ($p < 0.001$). The mean Nugent score was 3.2 ± 1.3 and 4.6 ± 1.5 , respectively ($p < 0.001$), while the relative proportion of Lactobacillus was $71.0 \pm 9.0\%$ and $61.0 \pm 10.0\%$ ($p < 0.001$; Table 2).

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Table 2. Post-treatment clinical and laboratory parameters.

Indicator	Study group (n=60)	Control group (n=60)	p
Clinical cure	53 (88,3%)	44 (73,3%)	0,037
Normalization of vaginal pH	51 (85,0%)	42 (70,0%)	0,049
Microbiological cure	49 (81,7%)	38 (63,3%)	0,025
Leukocytes, per field of view	6,1±2,2	8,4±2,7	<0,001
Nugent score	3,2±1,3	4,6±1,5	<0,001
Relative proportion of Lactobacillus	71,0±9,0%	61,0±10,0%	<0,001

The dynamics of intestinal microbiocenosis parameters are presented in Table 3. In the main group, after treatment, the level of Bifidobacterium increased from 7.4 ± 0.5 to 8.0 ± 0.4 log₁₀ CFU/g, Lactobacillus from 6.2 ± 0.6 to 7.0 ± 0.5 log₁₀ CFU/g, while opportunistic flora decreased from 4.5 ± 0.6 to 3.8 ± 0.5 log₁₀ CFU/g. In the control group, the corresponding changes were less pronounced (from 7.3 ± 0.5 to 7.5 ± 0.5 ; from 6.1 ± 0.5 to 6.4 ± 0.6 ; and from 4.6 ± 0.6 to 4.3 ± 0.6 log₁₀ CFU/g). The persistence of signs of dysbiosis decreased from 63.3% to 25.0% in the main group and from 60.0% to 48.3% in the control group. from 4.6 ± 0.6 to 4.3 ± 0.6 log₁₀ CFU/g).

Table 3. Model parameters of intestinal microbiocenosis (n=60 in each group).

Parameter	Main group, before	Main group, after	Control group, before	Control group, after
Bifidobacterium, log ₁₀ CFU/g	7,4±0,5	8,0±0,4	7,3±0,5	7,5±0,5
Lactobacillus, log ₁₀ CFU/g	6,2±0,6	7,0±0,5	6,1±0,5	6,4±0,6
Opportunistic flora, log ₁₀ CFU/g	4,5±0,6	3,8±0,5	4,6±0,6	4,3±0,6
Persistence of dysbiosis symptoms	38 (63,3%)	15 (25,0%)	36 (60,0%)	29 (48,3%)

At 3 months of follow-up, recurrence was recorded in 8 (13.3%) cases in the main group and 16 (26.7%) cases in the control group (RR=0.50; OR=0.42; p=0.068); that is, the difference did not reach statistical significance at this time point.

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At 6 months of follow-up, recurrence was observed in 10 (16.7%) cases in the main group and 21 (35.0%) cases in the control group. The relative risk was $RR=0.48$ (95% CI: 0.25–0.92), $OR=0.37$ (95% CI: 0.16–0.88), $p=0.022$ (Table 4).

Table 4. Disease recurrence at 3 and 6 months of follow-up.

Follow-up period	Study group (n=60)	Control group (n=60)	RR	OR	p
3 months	8 (13,3%)	16 (26,7%)	0,50	0,42	0,068
6 months	10 (16,7%)	21 (35,0%)	0,48	0,37	0,022

DISCUSSION

One of the primary challenges in treating recurrent bacterial vulvovaginitis is disease relapse. Although antibacterial therapy is aimed at eradicating the etiological agent, failure to fully restore microbiological balance can sustain a predisposition to recurrence [4, 6, 7].

In this model, clinical cure was achieved in 88.3% of patients in the main group compared to 73.3% in the control group. The main group also demonstrated superiority in terms of microbiological cure. The decrease in recurrence from 35.0% to 16.7% over 6 months of follow-up supports the benefits of an integrated approach. The lack of statistical significance at 3 months ($p=0.068$) may be explained by the cumulative nature of the probiotic effect over time or by an insufficient sample size.

International literature in this area also reports positive outcomes. A 2022 meta-analysis demonstrated that probiotics reduced the risk of bacterial vaginosis recurrence to $RR=0.55$ [14]. A 2024 meta-analysis encompassing 35 RCTs reported an OR of 0.34 for recurrence [15].

The crosstalk between the gut and vaginal microbiota is considered a potential mechanism underlying the obtained results. Lactobacillus strains may translocate

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via the perineal region to the urogenital tract and support the stability of the vaginal environment by producing lactic acid, hydrogen peroxide, and bacteriocins, as well as competitively inhibiting pathogen adhesion [11, 12, 17–19]. In this model, an increase in intestinal Bifidobacterium and Lactobacillus counts alongside a reduction in signs of dysbiosis occurred in parallel with an increased proportion of vaginal Lactobacillus and a decreased recurrence rate, which aligns with this hypothesis.

However, evidence in the adolescent female population remains limited compared with adult studies. Therefore, it is reasonable to investigate probiotics not as a universal cure, but as an adjunct to etiological treatment that supports microbiota balance.

Strengths and limitations of the study

The strengths of the study model include the presence of a control group, a comprehensive evaluation of clinical, vaginal, and intestinal microbiological parameters, and the analysis of outcomes at 3- and 6-month follow-ups.

The primary limitation is that all numerical results were generated as a statistical model. The sample size, group allocation, and laboratory parameters were modeled to establish the structure of the article. An actual clinical study would require the inclusion of individual patient data, laboratory methods, treatment protocols, and data verified by ethical approval documents.

Furthermore, generalizability of the findings is limited by the single-center design of the study, the relatively small sample size, the follow-up period being restricted to six months, and the lack of specification regarding the probiotic agent, dosage, and duration of administration.

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Practical significance. Should these findings be corroborated by real-world clinical data, incorporating the assessment and correction of intestinal microbiocenosis into comprehensive treatment algorithms for adolescent girls with recurrent bacterial vulvovaginitis may be warranted.

CONCLUSION

1. According to the modeled results, incorporating intestinal microbiocenosis correction into comprehensive treatment demonstrated a trend toward enhanced clinical efficacy.
2. Clinical cure rates were 88.3% in the intervention group and 73.3% in the control group.
3. Normalization of vaginal pH was 85.0% and 70.0%, respectively.
4. Microbiological cure rates were 81.7% and 63.3%, respectively.
5. Six-month recurrence rates were 16.7% and 35.0%, with the model showing an approximately 52% reduction in recurrence risk.
6. Prospective, randomized, and ethically approved clinical trials are required to establish the true clinical efficacy of this approach.

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